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March 19, 1927

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By Lucien Eaton

Provisions of the Mexican Mining Law of 1926
By Eduardo M. Butron

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By G. Newton Kirsebom

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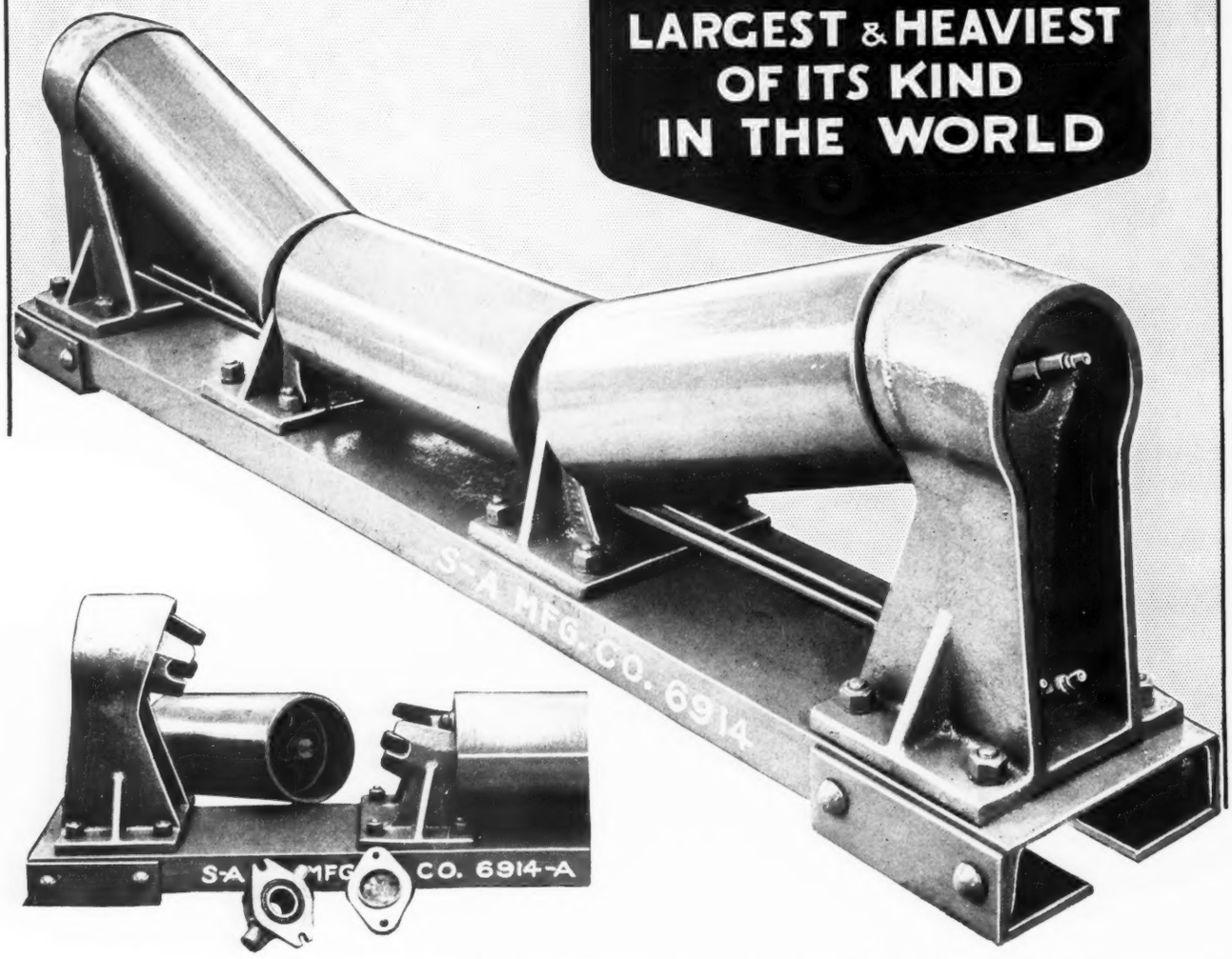

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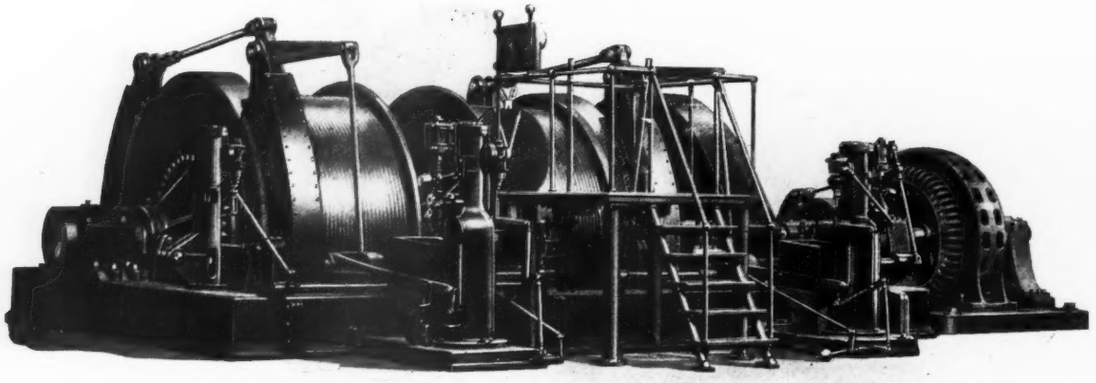
SHAFT HOISTS FOR COAL MINES



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ENGINEERING AND
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JOSIAH EDWARD SPURR, Editor

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The World We Live In

INDUSTRY AND FINANCE, after a year of expectancy of a reversal, accompanied by a general advance—looking one way, and moving another—has begun to argue that "the old order changeth, yielding place to new" and that major depressions are no longer to be expected. Meantime, those experts who have advised caution for the last year still advise caution—and what safer and more cautious advice? The demand for metals halts, and proceeds again—and if industry continues its steady path the mines will be busy providing for the demand. Whoever owns copper, or lead, or zinc, or tin, in the ground, has a safe and valuable bit of real estate.

Mining is constantly shifting the center of production. Some student should make a chart showing the migrations of this imaginary pole, over a hundred years or so. It will be found to be still moving. Africa, it becomes more and more evident, will be the great mining continent of the future, and between the Americas, South America is gaining in importance. The older mining countries gradually show the effect of past production—they cannot have their cake and eat it too. Organizations of mining engineers will raise their dues and drive for increased membership, and in the end will probably have to cut expenses, unless they can make themselves world-wide. The world is shrinking, and in slow and disorderly process of organization as a planet. Just now China looms portentous in this process, and the virtual alliance of Russia and China against the West. India is affected by the tremors of this human earthquake. Imagine a powerful China demanding its place in the sun—colonies for its surplus population. The East rankles under the treatment as inferiors by the West, and eventually there will be a show-down.

In Mexico unrest has engendered more unrest. The Knights of Columbus in the United States, according to their circular sent us, are raising a million dollars for propaganda against the Mexican Government. The circulars tend to disprove as ridiculous the Mexican charge that the Church has aspired to temporal power, while dispatches from Europe state that a move is on foot to have the Vatican represented in the League of Nations.

Propaganda is powerful, as witness what the Soviet is doing in China—great is propaganda. Great Britain is threatening to break off relations with Soviet Russia, thereby returning to the wise and dignified position of the United States—that she ever entered into such relations was a concession of principle to "dollar diplomacy" and to Soviet propaganda at home. Doubtless the Soviet doctrinaires are busy in Mexico also. They are busy and effective in countries where a lot of reform, of breaking away from ancient injustice and inequalities, is necessary: they appeal to the desperate, as at least a hope and a gamble. They are busy and ineffective in prosperous countries like the United States, and their fields are becoming sterile in Western Europe. War and poverty prepare the way for them; peace, justice, and prosperity automatically exclude them. Sabre-rattlers at home, who would march valiantly across country to Panama, should consider this.

Geophysics and Education Opportunities

INFORMATION upon the theory and use of geophysical methods is needed as well as fundamental research. The subject is new in many of its modern features but old in some of its more fundamental aspects. At Washington there is a geophysical laboratory, but its researches have involved physical chemistry as applied to geology; and the general subject of earth physics, comprising as it does gravitational, seismic, electrical, and magnetic phenomena in geological structures, has received comparatively little attention.

Mining geologists have studied mineral deposits and have evolved valuable generalizations upon structure, habit, and origin of such deposits. Interest has also been shown in the examination of outcrops, but perhaps the most important present-day development in ore-finding is the interest taken in geophysics in relation to discovery of mineral deposits. Accelerated consumption of metals, minerals, and petroleum must be met by greater knowledge and more scientific methods of discovery. Geophysics offers one of the most promising fields in this respect.

Following closely upon the heels of the need for information about geophysics is the need for education of technicians in this subject. Training in geophysics is hard work. The geophysicist must be a superior mathematician and must have a substantial background of knowledge in physics, chemistry, and economic and structural geology. Europe has made superior progress in the subject, as is exemplified by the fact that some of the universities offer post-graduate instruction; two journals devoted to the subject are published in Germany; recently Dr. R. Ambronn, of Göttingen, published a book dealing with fundamentals; another book, Lehrbuch der Geophysik, is appearing in installments. In our last week's issue, an article by Dr. Ambronn appeared dealing with a cognate subject.

In our own country, one mining school has established a department of geophysics and another has investigated methods of ore finding. In a commercial way, America has become the happy hunting ground for various companies who are selling their services to mining corporations and incidentally finding some ore and some petroleum. Not a great deal in scientific contributions to the subject is to be expected from these companies, which are generally using methods controlled by patents. Upon the fringes of the systematic work are various quacks, doodle bugs, and forked-twig experts. These impress the unwary and slightly fog the atmosphere.

Mining schools and universities, the U. S. Geological Survey, and the U. S. Bureau of Mines must necessarily take an active leadership in advancing geophysics and in educational work therein. There is a real opportunity for them to extend their services in this new direction.

California's State Mining Bureau

THE PRESENT LEGISLATURE of California is confronted by a plethora of bills calling for the reorganization of the State Mining Bureau. Not fewer than four bills are presented in extenso and four bills by title. Public attention is apparently not focused on any one bill and is apathetic. Nevertheless, there is a need for the reorganization of the State Mining Bureau and a definition of its functions in a clear and comprehensive way. The old organization has grown by piecemeal legislation and is antiquated, although the State Mining Bureau has rendered useful service to the mining industries. At present its functions comprise examination of ores and minerals for citizens of the state; control of oil-well drilling in the interests of conserving oil flow; investigation and bulletining of various subjects relating to mineral deposits; administration of the "high-grading" act; and the maintenance of a mining library and museum. The director of the State Mining Bureau is the state mineralogist. It is apparent to the friends of the bureau that its reorganization is desirable, and legislation is necessary toward this end.

Years ago California had a geological survey, but this was discontinued and in its place was established the State Mining Bureau in 1893. Many of the mining states maintain geological surveys as a means of encouraging the development of mining industries. Geological research is important, but it is obvious that a closer contact with mining is essential as well.

The legislative situation in California is more or less complicated by attempts to interject into the proposed laws establishing a department of mines and mineral resources a provision for the director to take over the functions in part of the California State Corporation Commission, which is administering the Corporate Securities Act. The Carter Assembly bill provides that "no company engaged or proposing to engage in the business of mining, developing or operating mining, oil or other mineral property, shall sell, except . . . ; or offer for sale, negotiate for the sale of, or take subscriptions for any security of its own issue until it has first applied for and secured from the 'director' a permit authorizing it so to do." The Inman Senate bill, No. 626, provides that "when the State Corporation Commissioner shall receive any application for permit to sell or issue securities as defined by the 'Corporate Security Act,' from a person or company engaged in or proposing to engage in the business of owning, developing or operating mining, oil or other mineral property, it shall be the duty of the State Corporation Commissioner to advise the director of the State Department of Mineral Resources relative to such application. Said director shall as far as practicable thereupon furnish to said Commissioner such data and information on said mineral property requested by the Commissioner as may be on file in the records of the department, together with such additional data and facts as may be secured through specific examination of the mineral property involved."

The liaison between the proposed department of mineral resources and the State Corporation Department is less objectionable in the Inman than in the Carter bill. There do not appear to be any real difficulties in the situation apart from this one, and the drawing up of a suitable bill could be speedily accomplished. However, the situation has an additional complication in that an attempt is being made to establish a department of natural resources of which mineral resources would be a part. No special enthusiasm for this superorganization is manifest, nor do there appear to be any trenchant reasons for it.

Idaho's State Mine Inspector

IDAHO was admitted into the Union in 1890, when commodity prices were far below what they are today. Shortly after admission, the office of State Mine Inspector was created, and attached thereto was a salary of $2,400 per year, and provision for one clerk. Nearly forty years have elapsed, and the salary remains the same, with no increase in office help. The mining industry of the State of Idaho has grown to large proportions, with an annual production of $30,000,000 and employing 6,000 men. Among the duties of the inspector are safeguarding the employees as regards working conditions in the mines and mills; conferring with operating officials as to safe mining methods; conservation and development of mineral resources; the protection of investors against fraudulent promotion; and a report to the Governor annually on the status of the mining industry—all for $200 per month.

According to the *Wallace Miner*, "A bill has been introduced in the legislature to increase the salary of the State Inspector of Mines from $2,400 to $3,000. It is so manifestly just and desirable that it should pass by unanimous vote. The wonder is that such a bill was not introduced and passed long ago. . . . Idaho is essentially a mining state and the development of its mineral resources is of the highest importance to all citizens, regardless of whether they are directly interested in mining. The inspector's annual report, which is a comprehensive review of mining in all sections of the state, based upon personal investigation, possesses great value both as an advertisement of the mineral resources of Idaho and as a permanent book of reference. From every viewpoint the services rendered by the inspector call for a higher salary. The pending bill providing for it should be passed without a dissenting vote, and there should also be a more liberal allowance for office assistance."

Considering the volume of work required of the inspector, the knowledge necessary to discern good and bad practices in mining methods, and the experience necessary to perform the duties in accordance with the law, the legislature would not go awry in at least doubling his present salary. A servant of the state is certainly worthy of his hire.

Curtailment in Copper Production

FROM THE MIXTURE of official statements and "reports"—more or less substantiated—that are circulating currently in New York regarding the curtailment in copper production, a reasonable conclusion may be drawn that in the aggregate the rate of production in March will be somewhat lower than it has been in recent months. Mine production in November was at the highest rate in history. The same may be said of refinery production in January. Stocks have increased steadily during the last five months for which data are available. These statistics, together with the

fact that some new production, notably from the Andes property in South America, must inevitably be added to the supply, have given the consumer of copper a distinct advantage in the market. Producers all knew that curtailment would be a splendid thing, particularly if someone else would do the curtailing. When, in February, the price slumped to 12½c. it is likely that some producers awoke to the realization that they had better not continue to wait for the other fellow to reduce his rate of production.

One element in the copper situation that cannot be ignored is that the watchful eye of the Federal Trade Commission is focused on the industry because of the existence of Copper Exporters, Inc. Any move affecting the domestic situation that might even suggest collusion, would be looked upon with suspicion. Certainly the performance of the producers within the last few months ought to demonstrate conclusively that there has been no understanding of any kind among them as to the rate of output. The curtailment that has taken place in recent weeks, in all reasonableness, may be ascribed to the belief on the part of individual producers that the policy will in the long run result in better earnings for the particular company.

Possibly the hesitancy of responsible officials of most of the companies to make a frank declaration regarding the current rate of production is caused by the feeling that some color might be given to the notion that curtailment had been instituted by mutual agreement. However, enough information is at hand from reliable sources to warrant the prediction that, barring increases from unforeseen quarters, world production in March will be at a rate about 10 per cent below that of January.

"Michigan Tech" and Latin America

WHAT IS IN A NAME? Much, under certain circumstances. The Michigan Legislature has seen fit to enact that hereafter the Michigan College of Mines shall be known as the Michigan College of Mines and Technology. In keeping with the new name, the curriculum will be broadened to include engineering subjects other than those concerned with mining. Thus students will be attracted that would otherwise look elsewhere, and an increased enrollment may be expected.

Of greater interest, however, than the change in name is the fact that the bill renaming the college also provides for a scholarship for each state and territorial possession of the Union, each province of Canada, and for each Latin American country. The last-named feature is a matter of importance.

Ten years or so ago it was that the Colorado School of Mines trustees took a step in this direction, voting as they did then to create certain scholarships for Latin American countries. Other cases might be cited. In all these the object sought has no doubt been to make the school that grants the scholarship better known abroad, and thus to attract new students.

Such scholarships, however, serve a greater purpose. It would be hard to estimate the profit to this country could more Latin Americans be influenced to come here for higher education in our universities and colleges. Each would return with a better understanding of the American people. Each would take back with him to his people the knowledge that the people of the United States as a whole desire only friendship and amity with Latin America, and that those here who would have this government encroach upon the sovereign rights of the smaller nations in this hemisphere are comparatively few in numbers and invariably with selfish ends to serve.

Of far more influence in bringing about a better international understanding would these Latin Americans be, on returning to their homes, than such theatrical gestures as "good-will flights" and the sending of special missions.

Pittman Act Still in Abeyance

THE FINAL SILVER PURCHASES under the Pittman Act, amounting to close to 15,000,000 oz., are again postponed by failure of the House to act on the measure in the closing days of Congress. The Senate has passed the bill two or three times, but effective opposition has so far prevented its consideration by the House. This time the silver producers apparently have Congressman Robert Luce, of Massachusetts, to thank for the failure of the House to act. Mr. Luce is president of Luce's Press Clipping Bureau, so possibly he will see this editorial, and we hasten to extend to him, in behalf of the silver producers, our regrets at his obstructionist policy.

The matter of the payment under the Pittman Act for the silver used for subsidiary coinage was thoroughly aired in these columns during 1923, and the justice of the claim has been pretty generally accepted by those who have made an impartial study of the matter. In the current session of Congress, the Senate again passed the bill, and a majority of the House Banking Committee recommended its passage in that body. Mr. Luce, however, made an adverse minority report, and through his efforts, it is reported, the House rules committee refused to let the House take up the matter in the closing days of the session.

So long as any influential people continue to believe that the taxpayers of the country are being mulcted of "$7,000,000 of their money to certain citizens who have given and who now offer nothing whatever in return," as Mr. Luce says, the winding-up of this long-drawn-out matter is going to be difficult. But Senator Pittman is not likely to give up, and the silver producers may perhaps be treated better by the next Congress. However, no gain in time has been made, as was expected, by appealing to Congress instead of carrying the matter before a court, and court action may, after all, be the final settlement of the difficulty.

Useful Operating Ideas

NEW WAYS of doing routine work; new designs of underground structures such as ore passes, ore chutes, transfers, shaft pockets, sumps, and scraper rigs; and improved details of track work, shaft guides, pipe work, skips, and cages, are constantly arising in the mining field. Likewise, in laboratory, mill, and smelter advances are being made in both methods and mechanical equipment and structures. Foremen, shift bosses, and miners as well as engineers, designers, shop, mill, and smelter men have in the *Journal's* Useful Operating Ideas department an opportunity to record definitely their contributions to the advancement of mining, milling, and smelting. Their co-operation has been important, but much more can be done to make our record as complete as possible. Useful Operating Ideas is open to all who are actively in the operating field and who are seeking to improve or to make safer mining, milling, and smelting work.

Up-to-date Practice at the Cliffs Shaft Mine—I

How a Hard-Ore Property in the Lake Superior Iron Country Is Run

By Lucien Eaton
Superintendent of Mines, Cleveland-Cliffs Iron Co., Ishpeming, Mich.

Lucien Eaton

THE Cliffs Shaft Mine of the Cleveland-Cliffs Iron Co. is the largest producer of hard specular hematite in the Lake Superior iron country. It is situated in the City of Ishpeming, Mich., and is one of the older mines of the Marquette range. Its total production up to the end of 1925 was nearly 8,500,000 tons. The first shaft was started in 1880 by the Iron Cliffs Co., locally known as the "Cliffs Co.," and this shaft was known as the "Cliffs Shaft" to distinguish it from other shafts being sunk by the Cleveland Iron Mining Co. It was in this way that the mine was given its rather unusual name. In 1881 a second shaft was started, both shafts being drop-shafts through quicksand, but this shaft was lost, and was abandoned for several years. It was finally recovered by the use of cast-iron tubbing, and was straightened and sunk to the ore. With the exception of the years 1893 to 1897 and thirteen months in 1921 and 1922 the mine has been in continuous operation.

The ore is a hard specular hematite, low in silica and moisture and containing appreciable amounts of lime and magnesia. The iron content is high, about 59 per cent natural, phosphorus 0.100 per cent, and silica 5 to 7 per cent. It is separated into two grades, "lump" and "crushed." The physical structure, low moisture, and low silica content make the lump ore especially desirable for the open-hearth furnace, and the crushed ore is an excellent addition to blast-furnace charges for increasing the output.

The Geology

The ore occurs in the Upper Marquette Series of Huronian age, and is overlain by the Ishpeming quartzite and slate, with a footwall of jasper and altered diorite. It occurs as an irregular bed, badly folded and faulted, varying in thickness from nothing up to 100 ft., with an average of 25 to 30 ft. in the larger orebodies. Whatever the original source of the ore or its method of concentration may have been, it is certain that the present orebody is not the result of chemical action, as are the soft orebodies in the Lower Marquette Series, but is due to concentration under water at or near the surface. There is an unconformity between the ore and the hanging wall and probably in many places between the ore and the footwall, although the latter is not easy to determine.

In general, the ore occurs in a syncline with an axis running east and west. This axis is not straight, but pitches downward to the east and west from a high point near the middle of the orebody. Both sides of the syncline are present only near the middle, one side or the other having been removed by erosion or displaced by faulting in the other parts of the mine. Three major longitudinal faults have been recognized, and several minor longitudinal and cross faults are known to exist. The dip of the ore is irregular and in general is too low for the ore to run on the footwall by gravity. This fact and the occurrence of many interbedded seams of rock in the ore have had an important influence on the choice of the method of mining.

Surface Must Not Be Disturbed

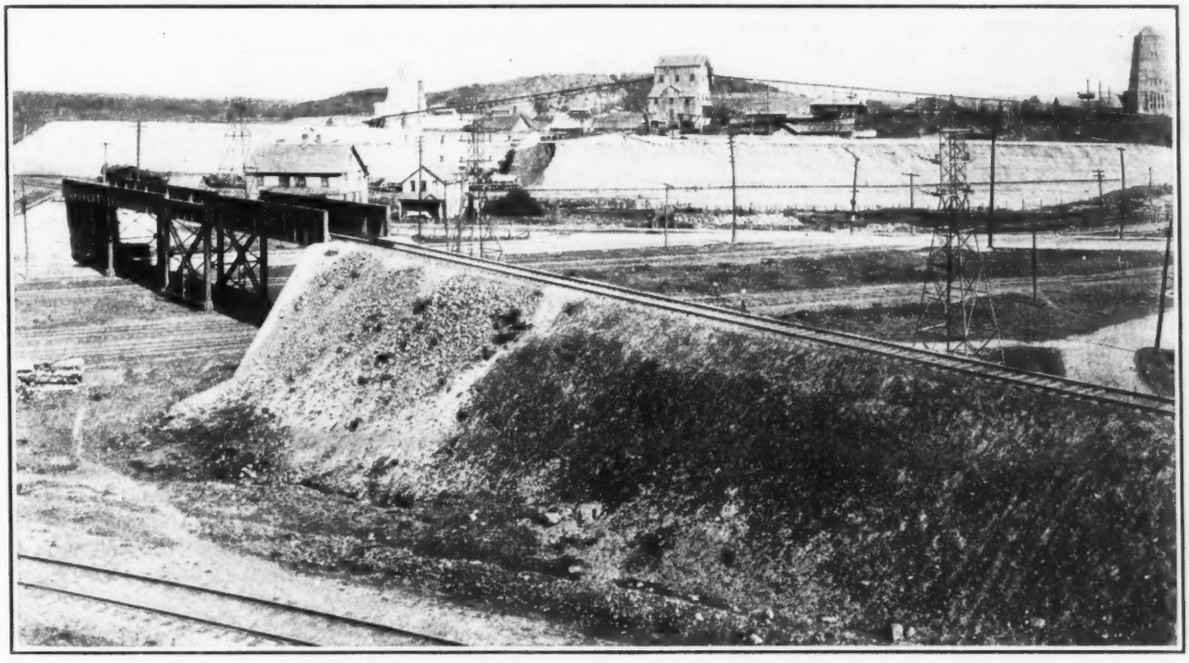
The ore formation is overlain by quicksand from 50 to 100 ft. in depth, and the orebodies have been followed for long distances under the business portion of the town, where the surface rights are not owned by the mining company. For both of these reasons it is necessary to use a method of mining that does not involve disturbance of the surface, and, as the ore is strong and stands well on exposure to the air, a system of rooms and pillars has been found to meet the situation admirably. This system also allows the ore to be carefully sorted underground in those places where it is mixed with rock. As the ore is sold on a guaranteed analysis which must be strictly maintained, it is essential that it be kept as clean as possible.

As Cliff Shaft is one of the older mines, the mine buildings are rather scattered. The shafthouses, "A" and "B," are made of reinforced concrete, and are 820 ft. apart, east and west. Between them are the engine house and the boiler house, built of stone, and a little further south stand the shop building, likewise of stone, and a steel crusher building, which is connected to the shafthouses by steel trestles. The loading pockets are in the crusher building, and the stockpiles are close by. There is a brick changehouse, or dry, north of the engine house on the shore of Lake Bancroft. This was one of the first dryhouses of the modern type built in the Lake Superior country. It was erected in 1901. The office and drill shop are built of brick, and are located nearer "A" shaft to the east. The grounds around the office and engine house are planted with trees and shrubs, and in the summer make an attractive setting for the plant. Money spent on the care of the buildings and grounds is well repaid by the quality of the labor attracted to the mine and by the mental attitude of the employees.

The old boiler plant was torn out about twenty years ago and was replaced by a new set of boilers with auto-

matic stokers, an economizer, and other equipment, but in 1910 steam was replaced by electricity from the company's own hydro-electric power plants. Power is brought in at 30,000 volts, 3 phase, 60 cycles a.c., to a transformer station, where the voltage is reduced to 2,200. All of the large motors on surface and those that drive the pumps underground receive current at this voltage. The steam plant is kept ready for service and is occasionally used for compressing air and pumping, when there is a shortage of electric power. Behind the boiler house there is a coal dock with a capacity of 7,000 tons.

The two shafts are vertical, and are 1,060 ft. deep, the bottom level being 1,000 ft. from surface. The shafts are similar in design, 10x14 ft. inside of timbers, and are close-timbered for 750 ft. In the last 310 ft. sets were placed on 5-ft. centers in the usual way, but this was found to be a mistake, as the ore that was spilled from the skips cut the wallplates away, and inside lagging had to be put in. There are fifteen levels. The first level is at 340 ft. from surface, and the level interval for the next four levels is 40 ft., and below the fifth level 50 ft. Between the tenth and fifteenth levels, however, the levels are not connected directly with the shafts, and all the ore below the tenth level is transferred to the fifteenth level by means of chutes.



The unique layout at the Cliffs Shaft mine. Left and right are seen the artistic concrete shaft-houses; in the center the crushing plant to which the ore is brought by the "top tram," first from one side and then the other; and below it the stockpiles

The hoist is an old one that has been rebuilt more than once, and consists now of two independent drums mounted on the same bedplate. The drums are 10 ft. in diameter with an 8-ft. face grooved for 1¼-in. rope, and are keyed to the shafts. They are driven by two 500-hp. induction motors with single reduction herringbone gears. A Lilly automatic control is provided for each drum. The engine house is between the shafts, and the hoisting ropes are carried nearly horizontally on low pulley stands to the shafthouses, where they pass under 8-ft. turnsheaves and go up almost vertically to the headsheaves, which are 12 ft. in diameter. In each shaft there is only one hoisting compartment, in which a 5-ton Kimberly skip is operated. On account of the hardness of the ore and the large chunks handled, the skip is very heavily constructed, and weighs approximately 10,000 lb. It is provided with safety catches, and has a small platform on top of the bail and a bonnet on the rope for the protection of men when riding. The skip is overbalanced by a 6½-ton counterweight, which travels inside a 12-in. pipe in the ladder and pipe compartment of the shaft. The counterweight consists of cast-iron cylinders, 11½ in. in diameter and 5 ft. long, strung on a 3-in. wrought-iron eyebolt 31 ft. long. It is free to turn in the pipe, and for this reason requires a regular lay rope. The skip rope is lang lay, 6x17 Seals patent construction, and both ropes are of crucible cast steel. The counterweight rope is wound on the drum opposite the skip rope exactly as if it were another skip in balance.

As there is only one hoisting compartment in each shaft, it is necessary to take the skip off and put the cage on when the men go on or off shift and at the noon hour. The cages are fully inclosed and have two decks, fifteen men riding on each deck. The change from skip to cage and cage to skip is made in five minutes, two and a half minutes being required for each operation.

Changing Skip and Cage

The mechanism for making the exchange is as follows: The skip runs on guides placed on the north and south sides of the compartment. These are 7½x 7½-in. dressed fir timbers 24 ft. long, hinged at the top and fitted with toggle switches at the bottom so that they can be thrown back far enough to clear the guides on the skip. There is a balanced drawbridge at the back of the hoisting compartment, and a transfer track running north and south in front. On this transfer

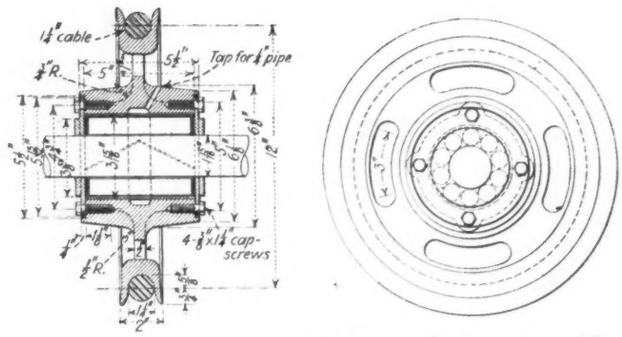


Fig. 1—Each of the twenty-two roller-bearing idler sheaves under the hoisting ropes is now of this design

track are two transfer trucks, and on these again are another set of auxiliary trucks, with tracks running east and west. The operation of changing is simple and rapid. The skip is hoisted until the bottom is 6 ft. above the collar, the drawbridge is thrown down, and an empty auxiliary truck is run out on the drawbridge under the skip. The skip is lowered on to this truck, the guides are thrown back, the pin is removed from the clevis on the hoisting rope, and the skip is pushed out upon the transfer truck. It is then pushed to one side, and the cage on its truck is brought into position from the other side, and the operation is reversed. Five men are required, consisting on day shift of the lander, two skip riders and two trackmen, who are also detailed to throw dull drill steel out of the skip after the cage has been put on, the last skip always being used to collect dull drills.

Head Sheave of Special Design

After extended experience with various kinds of head sheaves a special design has been adopted as standard. This is a bicycle sheave with an accurately machined renewable steel liner in the groove. The standard head sheave for all recent installations is 8 ft. in diameter in the groove and has a hub 20 in. long and a shaft 6 in. in diameter. As the Cliffs Shaft mine is an old property it was impossible to make all sheaves conform to this standard. With the exception of the two 12-ft. head sheaves for the skips, however, all the other head sheaves and turn sheaves are standard as to diameter, and all have the same length of hub, so that one spare will do for all.

There are twenty-two idlers under the hoisting ropes, and these have to be watched carefully to see that they do not cause undue wear. Cast-iron sheaves were too hard on the ropes, and wood-lined sheaves cost too much to maintain. Finally a small cast-steel sheave with a light rim and a long hub with roller bearings was tried, and has proved very satisfactory (see Figs. 1 and 2).

The shafthouses are built entirely of reinforced concrete, even the floor beams and the beams supporting the head sheaves being made of concrete. They were built around the old wooden shafthouses without interrupting mining operations. A description of their construction was published in the *Transactions* of the American Institute of Mining and Metallurgical Engineers in 1922.[1] These buildings are real reinforced concrete—not steel frames inclosed in concrete, as commonly constructed. They were considerably cheaper than steel, and have proved very satisfactory in service.

All the rock broken in the mine is used for filling old stopes, and from 15,000 to 25,000 tons of rock is dumped underground each year. If possible, waste rock is dumped directly, without hoisting, into some stope immediately below the level on which it was broken, but in many cases this cannot be done. To handle this material a pocket was built at the second level in each shaft, and a skip dump which has guides that can be thrown in or out was put in above it. This dump is used only at night, as the full capacity of the hoist is required on day shift for hoisting ore. No ore is hoisted at night, and the only men in the mine on night shift are the pumpmen and the rock trammers.

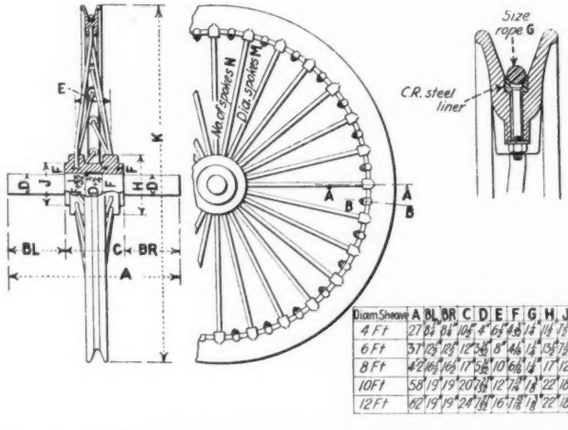
After the rock is dumped in the pocket, it is drawn off into 2-ton cars, and is trammed to the dump by a 2½-ton Whitcomb storage-battery locomotive. Either end-dump or side-dump cars are used as required for making a complete fill.

Top Tram and Crushing Plant Serves Two Shafts

In each shafthouse there is an ore pocket holding five skip loads, or 25 to 30 tons, into which the skip dumps directly. From this pocket the ore is drawn off into a steel side-dump car of 116 cu.ft. capacity, which is hauled up an inclined steel trestle, with a grade of 10 per cent, to a steel crusher building halfway between the shafts and a little to the south of them. The cars are hoisted in balance, and the power consumption is very small. The hoist is placed on the ground level under the crusher building, and has one 4-ft. drum with a single herringbone gear bolted to it. It is driven by a 100-hp. 2,200-volt a.c. slip-ring motor. The controller for the hoist is on the top floor of the crusher building, where the operator can see the cars and can spot one car at the pocket by the position of the other car in the crusher building. On the pinion shaft of the hoist there is a solenoid brake, so that the cars are instantly stopped if the current goes off.

As the track in the crusher building serves both cars, it must be level, and some means must be provided to pull the cars back out of the building and on to the incline. This is accomplished by a counterweight, which is picked up by the car as it enters the building and is dropped again as it starts down the incline. The cars are dumped by a 12-in. air lift mounted horizontally on the beams overhead.

Until 1926 all ore was carried from the shafthouses to the crusher building in 90-cu.ft., wood, gable-bottomed cars. To withstand the terrific pounding that



Diam. Sheave	A	BL	BR	C	D	E	F	G	H	J	K	M	N
4 Ft	27	8½	8½	10½	4	6½	4⅝	1¼	11½	4½	5.1	1	15
6 Ft	37	10½	10½	12½	5	8	4⅝	1¼	13½	5½	6.6	1¼	20
8 Ft	42	10½	10½	11½	5½	10	6⅝	1¼	11½	12	6.6	1¼	28
10 Ft	58	19½	19½	20½	8	12	7⅛	1¼	22	18	10.1	1¼	32
12 Ft	62	19½	19½	24½	8	16	7⅛	1¼	22	18	12.8	1¼	40

Fig. 2—The design of the steel-lined bicycle sheave which has been standardized to some extent

[1] "Building Concrete Shaft-Houses," by J. E. Hayden and Lucien Eaton, Vol. LXVI, p. 225.

they received from the large chunks as they fell from the pocket, these cars had to be very strongly built and were very heavy. When it became necessary to increase the output of the top-tram plant a different design of car had to be adopted, one that would combine lighter weight with greater capacity. An experimental all-steel, side-dump car weighing 1,500 lb. less than the wooden car and holding 2,500 lb. more was built, and proved so successful that the wooden cars have been discarded entirely. The newer type of car is shown in Fig. 3.

The crusher building is so arranged that the ore can be either crushed or screened. In the crushing department the ore is dumped down a chute into a No. 8 McCulley crusher with 18x42-in. openings, where it is crushed to 3½ in. This crusher stands on a solid concrete pier 58 ft. high, and is driven by a 125-hp. 2,200-volt induction motor. The product of the No. 8 crusher passes through a 48-in. x 12-ft. revolving screen with 3-in. round holes, and the oversize goes to two No. 5 McCulley crushers, where it is crushed to 2¼ in. The product from the No. 5 crushers joins the undersize from the screen, and falls into two small pockets, from which it can be drawn off into the stockpile cars or into the railroad pockets. All the No. 5 crushers stand on a solid concrete pier 42 ft. high. As the crusher building is closely underlain by 50 ft. of quicksand, a substantial base was necessary. The piers for the building itself and the two large piers on which the crushers stand rest in turn on a slab of reinforced concrete 50 ft. square and 3 ft. thick, which has proved entirely satisfactory.

In the screening department the ore is dumped down a chute, and passes over a rotary-disk grizzly with manganese-steel disks, 30 in. in diameter, mounted loose on a 5-in. square Agathon-steel shaft. The edges of the disks are 1 in. thick and the hub is 5½ in. long, leaving a clearance of 4½ in. The grizzly is driven at 55 r.p.m. by a belt from the countershaft of the revolving screen. Its success depends on having the disks loose on the shaft, so that they are self-clearing, and on having the peripheral speed great enough to throw the oversize chunks over the gap where the edges of the disks pass through the floor of the chute. The life of the disks is over 1,000,000 tons of ore, and failure usually occurs in the hub rather than at the rim. The rotary grizzly takes out everything over 4½ in. and passes it through chutes either to the lump-ore railroad pocket or to the lump-ore stockpile pocket, depending on the season of the year. The greatest difficulty in handling the coarse lump ore is to get it into the car without doing too much damage. Swinging baffle plates made of 2-in. manganese steel with 4 in. of steel behind them are used to reduce velocity and to cushion blows, and the chutes are lined with 60-lb. rails. They are inclined at 40 deg.

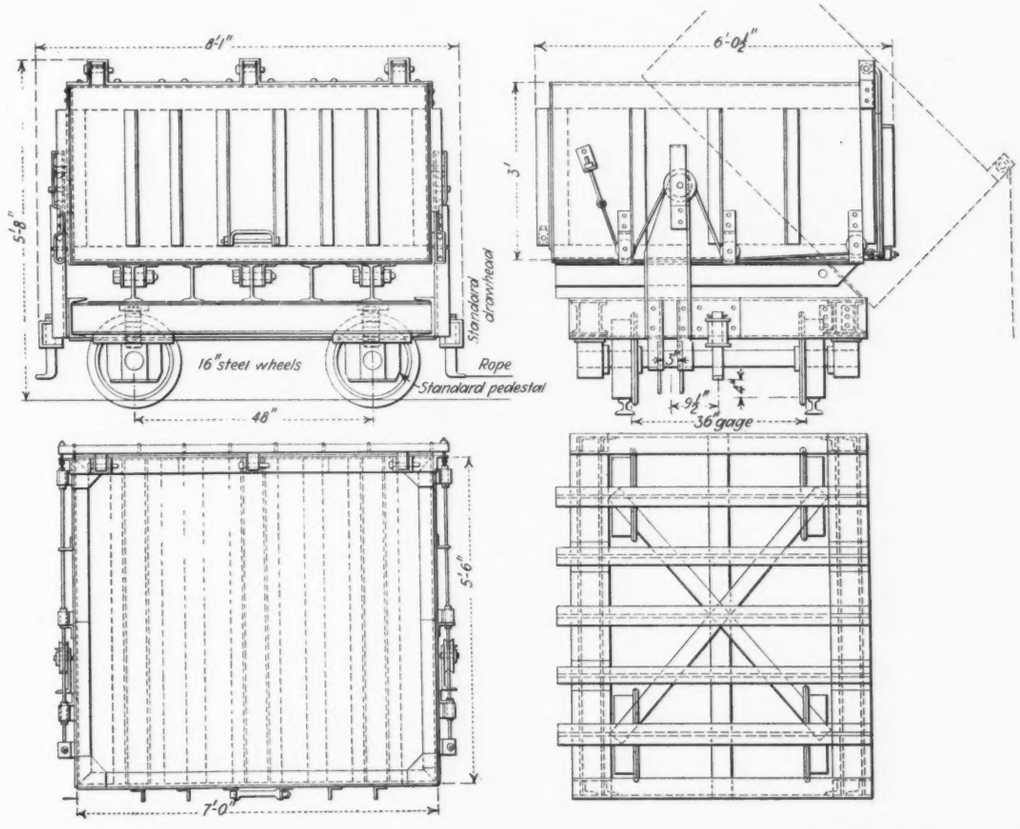


Fig. 3 — Sketch of the top-tram car, of 116 cu.ft. capacity. It is of all-steel construction and replaces a 90-cu.ft. gable-bottom car of wood, formerly used

Two-thirds of Product Is Lump Ore

The undersize from the grizzly passes through a 48-in. by 12-ft. revolving screen with 3-in. round holes, a duplicate of that in the crushing department. Oversize from this screen joins the coarse lump above the pockets, and the undersize falls into one of the small pockets below the No. 5 crushers. Over two-thirds of the total product is lump ore.

During the last ten years practically all the product from the mine has been screened, and less than 1 per cent has been crushed.

In addition to the crushing plant described above there is a 48-in. vertical Symons disk crusher near ground level, which can be used either to crush the screened or crushed ore from the mine to ¾ in. size or to crush stockpile ore dumped from railroad

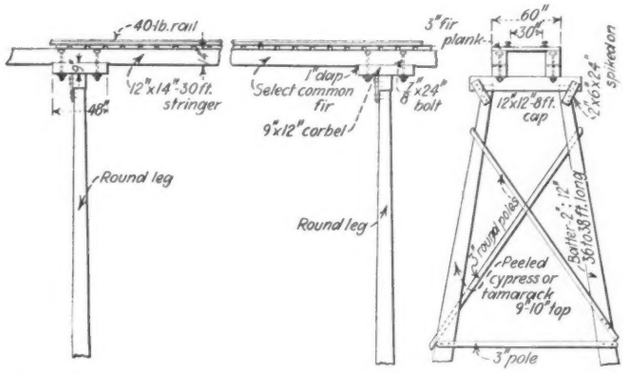


Fig. 4—Sketch showing a bent of the stockpile trestle and the structure above it

cars. As the undersize from the revolving screen is almost ideally prepared for the blast furnace, it has been necessary to use the fine crusher comparatively little.

Stocking Ore

The stockpile grounds lie immediately south of the crusher building and are parallel to the railroad tracks that serve the pockets. Their entire floor is covered with 3-in. plank, and room has been provided for approximately half a million tons. The ore is dumped from temporary wooden trestles in the winter time and loaded by steam shovel in the summer for shipment to the Lower Lake ports.

When the crusher building was designed, the demand for lump ore was much less than it is now, and the market could be supplied by screening in the summer time only. No provision was made for stocking lump ore. When later the market for this grade increased, facilities for stocking lump ore had to be provided, but it was necessary to take the ore out at a lower elevation than the crushed or screened ore, and this left a height of only 25 ft. above the stockpile floor. The car therefore could not be run out by gravity, and consequently endless-rope haulage was selected. Instead of hauling the car out on the level, it is hauled up a 3 per cent grade until a height of 38 ft. is reached, and from that point on the track is level.

Two trestles, one of which is filled at a time, with a combined capacity of 120,000 tons, are provided for lump ore for one season's operations. The haulage engine consists of a cast-iron sheave, 6 ft. in diameter, with a rubber-lined groove. It is keyed to a 6-in. shaft, which is driven through single-reduction herringbone gears by a 50-hp. motor. The haulage engine is situated in a small shanty beyond the end of the stockpile trestle, but the reversing controller by which it is operated is at the loading pocket, and is operated by the man who fills the car. As the engine itself needs no attention except oiling once a day, this saves one man, and it is unnecessary to provide any signals for starting and stopping.

An inclined gin pole is used in erecting the stockpile trestle

The stockpile car used is made of oak, and is of the gable-bottomed, self-dumping type. It holds 75 cu.ft., or nearly five tons.

Crushed or screened ore is stocked from another trestle by side-dump cars, which are run out by gravity, and are pulled back by a single rope. The wheels have roller bearings, and the cars are started on a 3 per cent grade, which flattens off to 1½ per cent a short distance outside the building. When this trestle has been filled, the pile is "fanned out" by side dumping, a method that works well with this kind of ore. Oddly enough, the power cost of pulling the empty car back, due to the fact that the motor is running all the time, is greater than that for pulling the loaded car of lump ore out and back and also greater than that of operating the top-tram hoist that pulls the cars from the shafts to the crusher building.

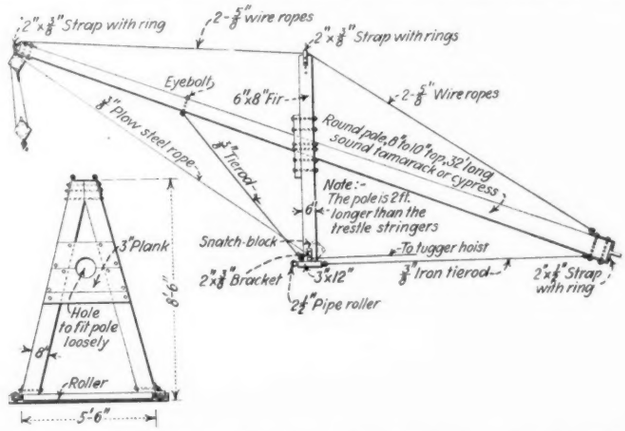


Fig. 5—Sketch showing the design of the inclined gin pole used in building trestles

The trestle is of the type standard in the district, and its design is shown in Fig. 4. The trestle legs are of cypress with 9-in. tops, and the caps, corbels, stringers, and planks are of Washington fir. Only the poles used for cross braces are obtained locally. "Select" fir, free from knots, is used for stringers. In erecting the trestle an inclined gin pole is used, which is shown in Fig. 5. Hoisting is done with a 10 HC Little Tugger hoist. This arrangement increases safety and reduces the number of men required for the erecting crew.

Shops Centrally Located

The carpenter shop, blacksmith shop, and machine shop are all in one building close to the crusher building and centrally located for the plant. In the carpenter shop there is a circular saw which is used for ripping plank and for making mine ties. All chute fingers, ladders, and wooden cars are made at the plant. Recently it was decided to make all cars of steel on account of the difficulty of getting satisfactory oak timber. This will relieve the carpenter shop of much work.

In the blacksmith shop are three forges, a steam hammer, punch and shears, and oxy-acetylene cutting and electric welding outfits. Skips, cages, cars, scrapers, and the usual mine repairs are made in this shop.

The machine shop has three lathes, a drill press, shaper, planer, pipe cutter, bolt cutter, hacksaw and

grinder. A great many drill parts, scraper blocks, car wheels, scraper hoists, and general repairs are made here. It is the policy at the mine to make all repair parts that do not require too great accuracy or too delicate treatment, utilizing in this work the men that are needed intermittently for special repairs.

Drill-steel Practice Carefully Regulated

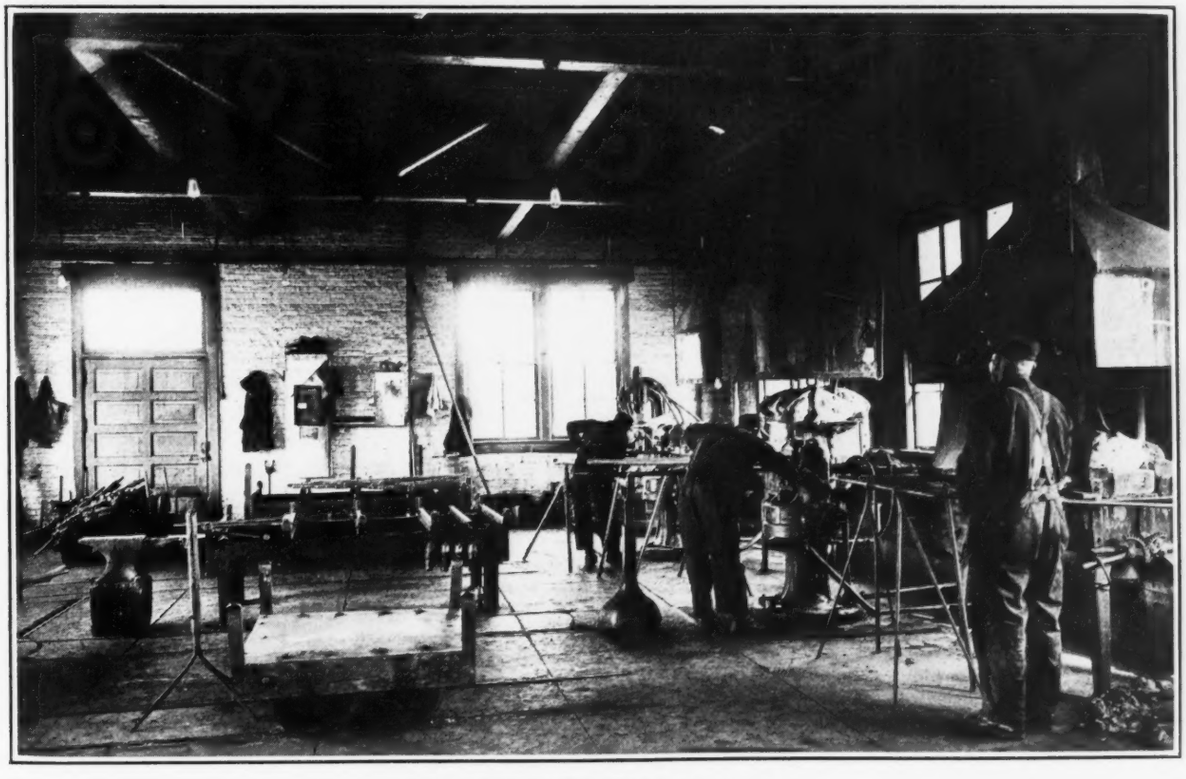
Three sizes of drill steel are used—namely, ⅞-in. hexagon hollow for block-hole machines; ⅞-in. quarter octagon solid for stopers; and 1¼-in. hexagon hollow without lugs for all other drills.

A comparatively small supply of the ⅞-in. hexagon hollow and ⅞-in. quarter octagon solid steel is used—seldom more than 3,000 lb. in all; but there is approximately 60,000 lb. of 1¼-in. hexagon hollow steel in circulation all the time. Each contract has its own steel, stamped on the shank with numerals one-half inch high, and receives each day the same steel sharpened that it sent up dull the day before.

The steel is sharpened in a special drill-sharpening shop close by "A" shaft. It is heated for forging in an I.-R. No. 25 oil-burning forge, and is sharpened in two I.-R. sharpeners, one No. 5 and one No. 50. A double taper cross bit is used, having an angle of 105 deg. for the cutting edge. The steel is allowed to cool, and is then heated to 1,450 deg. in a Sullivan oil-burning forge with a pyrometer attached. This pyrometer does not control the flow of oil, but merely gives a warning by a signal light: red when the forge is too hot, white when it is just right, and green when it is too cold. The steel is tempered on a rising temperature in a slightly reducing atmosphere, and is tested with a magnet for loss of magnetism before it is plunged into a tank of clean water. Various schemes and devices for tempering have been tried, but have not been as satisfactory as the method described. One man does all the tempering, so that there is no chance to "pass the buck." He also inspects the steel and is responsible for the quality of work turned out.

The tempered steel is removed from the tank by a bundler, who sorts it according to the numbers stamped on the shanks and places it in the proper compartments of a large horizontal pigeonhole rack, from which he takes it later and makes it up into bundles weighing 100 to 125 lb. The steel in the bundles is held together by iron rings, 4½ in. in diameter, and hard-wood wedges. One clean wedge is used in each bundle, and the contract number is written on this wedge with blue crayon. The wedges are made of maple and are bought from a local lumber company. The temperer is the shop foreman, and he keeps a daily record of the number of bits sharpened and of the number of broken steels that come in. A power hacksaw, emery wheel, and countersink drill are provided in the shop equipment, so that practically every operation in cutting and preparing steel as well as sharpening is done there without extra help. When new steel has been cut by the hacksaw, the shank is ground true and chamfered on the emery wheel and is counterbored for the water tube. It is then heated and stamped with the proper number, heated again, and tempered in oil.

The oil used is 36-38 deg. distillate and is bought in carload lots. From the storage tanks it is pumped to a 350-gal. tank outside the drill shop, by which the consumption is measured. Consumption varies between 1,000 and 1,200 gal. per month. This furnishes the heat for the sharpening and tempering of all the steel for seventy-five machines working on single shift, for this shop sharpens the steel for the Holmes mine as well as for the Cliffs Shaft. Careful record has shown that since the oil burners were installed the number of steels



Drill shop of the Cliffs Shaft mine

used per 1,000 tons of ore produced has been reduced to only 55 per cent of the number required when heating was done in coke forges. The number of men required has been proportionately reduced also.

Air for the drills is furnished by two 2,500-cu.ft. Type PRE two-stage Ingersoll-Rand compressors, direct-connected to synchronous motors, and by a straight-line, two-stage, Allis-Chalmers belted compressor. These operate at a pressure of 85 lb. per square inch at the compressor. When electric power is not available, there is a 4,000-cu.ft. cross-compound, two-stage Nordberg compressor, driven by steam. This is a very efficient machine, but is designed for pressures not to exceed 75 lb. per square inch.

The piping system was designed for a line loss of not to exceed 10 lb. between the compressor and the drill, but in some cases the loss exceeds this amount. Periodic readings of pressures at the drills are taken and are compared with the record of the gage in the engine house, and when excessive line loss is found measures are taken to reduce it. There is a 6-in. air line down each shaft, with 3-in., 4-in., and 5-in. lines on different levels, depending on the number of machines to be served. By the use of these larger pipes loss by leaks has been so much reduced that in spite of the higher air pressure used and the greatly increased use of compressed-air machinery about the plant, both on surface and underground, the number of cubic feet of air per ton of ore produced is less than it was fifteen year sago.

Pumping by Electricity

Except for two short periods, when there was a shortage of electric power, all pumping has been done by electricity for nearly fifteen years. The flow of water varies from 600 to 1,200 gal. per minute, according to the season of the year and the amount of rainfall. To handle this water there are two 600-gal. horizontal duplex Prescott plunger pumps and one 500-gal. Prescott centrifugal pump, all for 1,000-ft. head, in a large pump house on the fifteenth level in "A" shaft. All the pumps are direct-connected to 2,200-volt a.c. motors made by the General Electric Co. There are duplicate power cables in the shaft, but the extra one has never been needed. The water column is of 8-in. extra heavy pipe with extra heavy steel flanges, and rests on a heavy steel girder in the shaft at a point just above the fifteenth level.

The floor of the pump house is 6 ft. above the floor of the level, so that, in case of accident to the power line or pumps, not only the sump but also nearly 4,000 ft. of drift must be filled before the water rises to the motors. The sump has a capacity of 125,000 gal., and has a sand sump 8 ft. square and 10 ft. deep just outside the inlet with a screen to keep out chips. This catches most of the sediment, so that the main sump has to be cleaned out only once in three years.

There is a steam pump as a relay on the tenth level, but it is seldom used. Most of the water can be caught on this level, if desired.

To reduce the amount of rock drilling that would be required to explore all the horizons at which ore is likely to be found, a diamond drill is kept in almost constant use underground. This is a screw-feed, "Beauty," Sullivan machine, using E-rods, run by compressed air. Although much of the ground is very hard, nearly all of it is solid, and drilling costs are surprisingly low.

To be concluded

World Aluminum Production Estimated at 210,000 Long Tons in 1926

During the first nine months of 1926 the development of the world's aluminum industry made new high records, but in the last quarter distinctly reactionary market conditions ensued, according to a review in *The Economist*, of London. The English trade price was reduced from £120 to £107, and the export price from £125 to £112 a long ton. World production again increased, being placed at roughly 210,000 long tons, of which about 107,000 long tons was produced in the United States and Canada combined, the balance of about 103,000 long tons being contributed by European producers. America is still easily first among producers, with an output of about 90,000 long tons per annum. Germany now comes second, with close on 30,000 long tons, other important producers being Norway, France, Switzerland, Canada and Great Britain, while Italy and Austria are producing fair tonnages, and new works are planned in Japan, Russia, and Spain, where no aluminum has been made so far. A feature of the European situation has been the formation of a combine, including the German, Swiss, French, and British producers, the object of which is to regulate production and stabilize prices, while there is evidently some apprehension of the formidable competition of the Aluminum Company of America on account of the activity of its new plant at Arvida, Quebec, the full working capacity of which, about 180,000 tons per annum, may not be reached for another year or so.

American imports of dutiable aluminum pig, scrap, and alloys, in 1926, were about 31,000 tons, an increase of nearly 1,000 tons over those of 1925. British producers did well, exports of crude metal in ingots and blocks being 4,100 tons, as against 3,717 tons in 1925, while exports of manufactured aluminum amounted to 3,468 tons, compared with 3,144 in 1925.

How Copper Rods and Wire Are Drawn

Copper wire and rods are made from refined metal cast in the form of wire bars, the processes used being described briefly by F. P. McCue in a recent issue of *The Anode:* The wire bar is passed through a series of rolls, each set of which reduces its diameter and increases its length until it finally emerges as a rod of the required size. Very thin rods are further reduced by being drawn through one or more chilled steel dies.

Another method of producing rods is that of extrusion. A billet of red-hot metal is placed in an extruding machine where a great hydraulic plunger presses it through a die in the same manner and just as easily as tooth paste is squeezed through the opening of a tube. As a rule only one operation is required when this method is employed, although in some instances rods are drawn through dies after being extruded in order to give them additional strength and hardness. The most noteworthy advantage of the extrusion method is the great variety of cross-section shapes that can be produced.

Wire is manufactured in much the same manner as rods, except, of course, that it undergoes many more drawing operations. Small sizes of wire are frequently drawn continuously in one operation through a number of dies, each die in turn reducing the wire's diameter and increases its length. In this manner wires can be drawn as fine as 1/1,000 of an inch—diamond dies, instead of steel, being used for the very small sizes.

Pharaohs Mined Turquoise in 3200 B. C.

First Organized Operations for the Recovery of Precious Stones Were Conducted by Egypt's Kings in Sinai Peninsula

By Sydney H. Ball
Mining Geologist, New York City

Sydney H. Ball

THE FIRST large operation in one of the basic industries is of marked historic interest, particularly when some of its features are surprisingly modern. The winning of flint from open cuts may well have antedated Sinaitic turquoise mining; but the work was carried on by savages from time to time as the tribal needs for weapons dictated. The Egyptians for over 2,000 years, beginning back more than 5,100 years[1] ago, mined turquoise, still a popular precious stone, and were good enough to leave inscriptions from which a fairly satisfactory idea can be obtained of their methods of mining and their ideas as to mine organization. Many of the problems which worry the mine manager of the present day then existed, and on the whole appear to have been satisfactorily handled. This article is an attempt to picture, from the writings of various Egyptologists, the earliest efficiently organized and large mining operation: The winning of turquoise.

The Egyptian loved ornaments and favored vivid color contrasts in them. In consequence he fashioned into most effective jewels the deep-blue lapis lazuli, the red carnelian, and the light-blue turquoise. His nation early in history was rich, and in consequence he was able to satisfy his love of the beautiful.

Turquoise beads in relative abundance are found in pre-dynastic tombs of the last half of the pre-dynastic period (that is before 3400 B.C.), and thereafter the stone is a common material of the Egyptian artist and jeweler. Doubtless this pre-dynastic turquoise, like that used later, came from the Sinai Peninsula, but probably, unlike the latter, which was mined by Egyptians, it was gathered perhaps from surface outcrops by the Monîtû, the aboriginal Arabs of the Sinai Peninsula, and passed by barter to the Nile.

Ancient Mines Six Days by Camel From Suez

The principal Sinai turquoise localities are Wadi Maghara and Serabit El Khâdem, in a region of Carboniferous red sandstone. The two districts are ten miles from one another and are six days by camel from Suez.

The gem fills cracks, most of which strike north and south, according to J. K. Lord.[2] It also occurs as nodules in the rock, and these are frequently of excellent quality. There are two gem horizons, the upper and richer being about 15 to 20 ft. above the lower. In one of the gem horizons at Serabit el Khadem, Petrie reports three separate layers, respectively 20, 55, and 10 in. thick, which carry gems. The more ocherous and iron-rich the sandstone, the finer is the color of the gems. A large per cent of the stones recovered are, however, white and worthless.[3] Above the sandstone is basalt, but T. Barron, of the Egypt Survey Department in 1907, believes that the gems were formed by circulating waters, without connection with igneous rocks. Maspero says that Wadi Maghara was known among the Egyptians as Baît ("the mine par excellence") or Bebît ("The country of grottoes"), and the present Arabic name is the equivalent of the latter ("valley of grottoes"). The "grottoes" were evidently the mine workings.

The kings of Egypt early sent expeditions of miners to Sinai to win the coveted gem. Semerkhet, the seventh king of the first dynasty (about 3200 B.C.), was the first whom we actually know worked the mines, but Usephais, the fifth king and his predecessor by some fifty years, fought with the natives of the turquoise region, indicating that if perhaps he did not mine the turquoise he at least was the first to risk money in an attempt to do so. Operations were particularly extensive under Snefru, of the third dynasty; certain of the kings of the fourth, fifth and sixth dynasties; Amenemhet I, of the twelfth dynasty; Hatshepsut, Thutmose IV, and Amenhotep III, of the eighteenth dynasty; Seti I, of the nineteenth dynasty; and Ramses IV, of the twentieth dynasty. The last name we find at the mines was that of Ramses VI (1150 B.C.).

Intermittent Exploitation for 2,000 Years

From this list of royal mining adventurers it will be noted that the mines were worked rather continuously during long periods: from the third to the sixth dynasty (2980 B.C. to 2475 B.C.), the twelfth (2000 to 1788 B.C.), and the eighteenth to twentieth dynasties (1580 B.C. to 1150 B.C.). They were apparently practically abandoned at others. Actual exploitation, however, extended over a period of some 2,000 years. After the twentieth dynasty mining languished, but a piece of Roman pottery suggests that at least the mines may have been visited by Roman travelers.

Maghara was at first most actively exploited, and appears to have been practically exhausted at the beginning of the twelfth dynasty (2000 B.C.), but luckily Serabit was re-discovered (the original discovery was made in Snefru's time) in the reign of Senwosri I, the second king of that dynasty. Later in the same dynasty the demand for turquoise so increased that Amenemhet III reopened the Wadi Maghara deposit, and both districts were exploited at least till the beginning of the thirteenth dynasty (1788 B.C.). Ramses III (1200 B.C.) was satisfied with the result of his

[1]The chronology used is that of James H. Breasted, "A History of Egypt."

[2]"Leisure Hours" Vol. 19, p. 393-9 and 423-6; 1870.

[3]H. Bauerman: *Journal of the Geological Society* of London, 1869: Vol. 25, p. 17-39.

exploitation of the Serabit el Khâdem mine, for he modestly says[4]: "There were brought to me marvels of turquoise in numerous bags carried before me, not to be seen again while there are kings."

When the Egyptians arrived in the region they found the natives worshipped a god and goddess, whom the Egyptians in their eclectic polytheistic system assimilated and identified with their own Horus and Hâthor. Thereafter Hâthor was the patron goddess of the mining region, and she was known as the lady of the country of Mafkat (that is, of turquoise). Snefru I, king of the third dynasty and the first great magnate of the industry, was also worshipped. All later entrepreneurs boasted that their work was the most important since his day. These three were the patrons of the mining communities. Ramses III (twentieth dynasty) says in the Harris papyrus: "I sent officers and chiefs to the land of Mafkat of my mother Hâthor, mistress of turquoises, carrying to her silver, gold linen, mixed linen things. There were brought to me marvels of real turquoises in many bags." Like the peon miner, the Egyptian was sufficiently superstitious to believe that religious offerings would be repaid many fold, and a temple and numerous shrines were dedicated to Hâthor. One successful manager adds to the account of his expedition[5] "offer ye, offer ye to the mistress of Heaven, appease ye Hâthor: if ye do it, it will be profitable for you. If ye increase to her, it shall be well among you. I led my army very kindly and I was not loud voiced towards the workmen."

Mining was carried on by expeditions dispatched from Egypt. These were large and consisted of high officials, a few engineers and prospectors, and many laborers of various sorts, totaling in instances 2,000 or 3,000 men. They also had an adequate military escort, one consisting of 734 soldiers. The natives did not permit their land to be occupied without a struggle, and the Egyptians either paid tribute to them for the privilege of mining (incidentally probably the earliest known mining royalty) or were compelled to protect themselves by force of arms. This is not surprising, inasmuch as the aboriginal Arabs must have resented advancing civilization.

Highly Organized Undertakings

The organizing ability of the Egyptians was exemplified in these expeditions as in all of their major activities. The leader was a high official in the king's confidence and usually a native of northern Egypt, since such a one would be likely to know the customs of the laborers with whom he had to deal: other high officials were his aids, in charge respectively of supplies, transport, and accounts.[6] Subordinate to these were storekeepers, a captain of boats, an officer in charge of escort, interpreters, king's representatives, chief mine foreman, and stewards for the staff's mess. One expedition had a chief medical officer. In another expedition there were chief foremen, each with ten master miners, and the latter had under them about ten laborers. Some of the expeditions had from 400 to 500 miners, and in certain expeditions, at least, soldiers were detailed to do mining part of their time. Petrie translates "mes-en-âati" as "deviser of minerals," or a prospector, and there was usually one of these to from 60 to 225 men. There was also a "collector of turquoise," apparently one who took charge of the output. Copper smelters, cooks, and bakers are sometimes mentioned. There were also masons to build temples, peasants to drive the asses (of which several hundred were required to provision the expedition), boatmen, and others. The common labor in part was recruited from the local population.

In the stele commemorating the expedition the general manager's name was in large characters and the names of his staff also appeared. Surreptitiously in many cases even menials scratched their names thereon.

The expeditions were, so far as food is concerned, independent of the country, the food being packed from Egypt on asses, which also were used at the mines to carry in water. A large mussel lived in the pond formed by damming the waters of the gulch for a water supply, and this together with dates, oil, and coarse bread comprised the ration of the miners, supplemented occasionally with a few vegetables and from time to time a fowl or a joint of meat. One food convoy brought corn, sixteen oxen, and thirty geese, and, in addition, chickens and fresh vegetables. In fact, the laborers appear to have been furnished a well-balanced diet. Coarse pottery was made locally, but the finer dishes were imported from Egypt.

Two Routes to the Mines

The expeditions arrived by one of two routes: either the short boat trip across the Red Sea with ass transport to the mine, or the longer land trip around the head of the Red Sea. The expedition apparently left Egypt in November or December, and after remaining several months (usually from mid-January to April first, or even to mid-May) normally returned before the summer's heat set in. Rarely, however, the expeditions appear to have braved the summer heat, and some expeditions even spent three years at the mines. G. Maspero, however, believes that a regular force of several hundred men were kept at the mines, and that these were visited regularly by royal inspectors. In his opinion, if a king needed more turquoise he speeded up production by sending out a special mining expedition.

A number of mine openings exist at both Wadi Maghara and Serabit el Khâdem. The ancient workings as now seen consist of wide stopes (up to 50 ft. across), and galleries following the more or less horizontal turquoise-bearing beds. From these, tortuous little galleries lead off following particularly promising stringers. One gallery at Serabit, 220 ft. long, holes through a narrow ridge, and from it is a raise to the surface. The workings extend for 300 yd. along the cliff face. Here and there the roof was supported by large pillars. In one place, where the gem horizon was unusually thick, a hanging-wall slice was first taken and then the lower slice later removed. Where the turquoise-bearing beds have no overburden they were worked in quarries. All in all the workings remind one strongly of some of those to be seen at Silver Reef, Utah. On the walls of the workings are gad marks which correspond to some of the flint and copper chisels found on the surface around the mines.

The tools, hammers, nails, picks, and chisels used consisted largely of stone, although some copper chisels have been found. J. de Morgan[7] believes that copper tools were introduced in the twelfth dynasty. As to the use of tools, there has been considerable difference of

[4]Rawlinson: "A History of Ancient Egypt," Vol. II, p. 378.
[5]Breasted: "Records of the Past," Vol. I.
[6]W. M. Flinders Petrie: "Researches in Sinai," p. 109-21.
[7]Recherches sur les origines de l'Egypte; L'Age de la Pierre et les Metaux.

opinion among Egyptologists. E. H. Palmer and W. M. Flinders Petrie consider that bronze or copper tools alone were used in mining; and photographs of some of the workings indicate this to be true. Others think that stone tools were also used, not only in freeing the gangue from the turquoise but in mining as well. Perhaps in later times copper tools alone were used, but in earlier work stone tools were undoubtedly used for actual mining. The copper chisels were about 6 in. long.

When a mass of turquoise was found, the soft sandstone around it was cut away, and it was carried to the surface, where the best was hand sorted and then the rest crushed and sifted to recover the last particle of the gem. Production was never large in the modern sense, although in one year over 400 kg. (882 lb.) of turquoise were produced, admittedly a large quantity of gems. Copper and manganese ores were byproducts, the oxidized ores being used in tinting the enamels for which the Egyptians were famous, and the copper ore, as well, being smelted. Malachite was also produced, a substance used by the Egyptians from the earliest time, not only as an ornamental stone but as a pigment.

Development Maintained With Optimism

With the dispatch of a large expedition every three or four years, and at times each year, the oreshoots were rapidly worked out, and the question of reserves became a serious problem. One of the leaders of an expedition of Amenemhet II (twelfth dynasty) was Captain Haroëris. His early efforts at Serabit were disappointing, but he kept up development work with fine optimism. He and his men finally were almost in despair; "the desert burned like summer; the mountain was on fire." Finally one morning the overseer questioned certain miners familiar with the peculiarities of the deposit; they expressed their confidence in the mine as follows, "There is turquoise for eternity in the mountain." That very day a pay shoot was found, and three months thereafter Haroëris returned to Egypt loaded down with turquoise.[8]

Steles found at the mine give many details regarding mining. They tell us of the defeat and dispersal of marauding Bedouin bands; that no lives were lost on the expedition; that the production decided upon before the expedition left Egypt had been attained; that the heat endured at the mines was terrific; and that the expedition leader had been uniformly kind to his men.

A "Gift of the Gods"

We as mining men often refer to an event as being "four years after Goldfield was discovered," and similarly a Sinaitic stele of the reign of Dedkere-Isesi (fifth dynasty) (2650 B.C.) is dated in the year "when the gods caused that costly stone to be found in the sacred mine."[9]

The names of the mines are interesting, and the Egyptian was not adverse to calling them after the deity; one, for instance, was called "Vision of the Beauty of Hâthor"; a peculiar name is that of "Flourish its army that which is in it," which James H. Breasted interprets to indicate the preciousness of the product. Under Amenemhet III (twelfth dynasty) each working place was named after the foreman in charge.

Leasing was apparently, in instances, done, and from the inscription of Amenemhet, an expedition leader in the twelfth dynasty, we find one of the leasers was named Ka. The inscription follows[10]: "I came to the mine of Ka: I exacted the impost. I attended to the levying of the impost of malachite [more probably turquoise—S.H.B.] being . . . for every five [or perhaps fifteen] men every day correctly. . . . Never had the like been done since the time of the King of Upper and Lower Egypt, Snefru, triumphant."

At Wadi Maghara, on a small table land, are some 200 sandstone huts used by the ancient miners, and, at the foot of the mesa, more pretentious huts for the mine bosses and engineers. A partially ruined wall extends across the valley. There was also a fortress. Watchmen were posted on the near-by heights to warn the garrison and workmen of approaching attacks, and, once the alarm was given, the miners all scurried to the fortress. At Serabit el Khâdem, in addition to the ruins of the camp, is that of a large temple.

Turquoises Provided Money for Purchasing Wives

These old mines were re-discovered in 1845 by Major C. K. McDonald, and in 1854 he began mining at Maghara on an extensive scale, employing many Bedouins. In 1866 he quit, and moved to Serabit, which was abandoned the next year, as, after marketing, the stones from both mines were found to soon lose their color. Later a Frenchman worked the mines for a short time. In 1903 English promoters obtained a concession from the Egyptian Government to work the mines, but the attempt was a miserable failure, and work continued for only a year or two. Unfortunately, their employees destroyed some of the more interesting ancient inscriptions. Bedouins still, from time to time, dispose of a few turquoises, which they obtain from these and other mines in the peninsula, for gunpowder and other necessaries. One of the mines is known as El Hejija, as from the product a pilgrimage to Mecca was financed.[11] If lucky, a young Arab may make enough to get money to purchase his wives.[12]

It is, of course, possible even in pre-dynastic times that some turquoise was brought to Egypt from Persia by the same traders who brought lapis lazuli, as Joseph E. Pogue suggests. We have, however, no evidence that the Nishapur mines date that far back. In mid-Egyptian history turquoise was frequently obtained either by trade or by conquest from the Asiatic peoples. Whether this was of Persian or Sinaitic origin cannot be determined. At times also other parts of Africa probably supplied the Egyptians with turquoise. It is reported to be found at Got, near Angololo, Abyssinia, and there are indications that in the twelfth dynasty turquoise may well have been obtained from Sudan.

[8]G. Maspero: "History of Egypt."

[9]J. H. Breasted: "Records of the Past: Ancient Records of Egypt." Vol. 1 p. 120.

[10]James H. Breasted: "Records of the Past." Vol. 1, p. 320.

[11]E. S. Thomas: *Mining and Engineering World*, July 13, 1912, Vol. 37, p. 53.

[12]T. Barron: Sur. Dept. Egypt, 1907.

Mineral Land Withdrawals

Mineral land withdrawals and classifications as of June 30, 1926, totaled the following: Coal withdrawn, 30,545,315 acres (classified as coal land, 31,874,831 acres); oil lands withdrawn, 5,808,559 acres (classified as oil lands, 71,842 acres); oil-shale lands withdrawn, 156,147 acres (classified as oil shale lands, 4,116,097 acres); phosphate lands withdrawn, 2,055,992 acres (classified as phosphate land 297,705 acres); potash lands withdrawn, 7,548,377 acres.

Provisions of the Mexican Mining Law of 1926

By Eduardo M. Butron
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MUCH uncertainty has existed regarding the interpretation of the provisions relating to mining in the Mexican Constitution of 1917. The laws that became effective on Aug. 1, 1926, did much to clarify the situation. A résumé of some of the points in the "Law of Mineral Industries" should help the mine operator to determine where he stands.

First, the law defines the mineral resources that are under the administration of the nation and those that belong to the owner of the surface. It establishes immunities and exemptions from taxes for certain new enterprises in the country, with the object of encouraging them. This applies principally to those which have as their basis the development of non-metallic ores thus far almost unexploited.

The law prescribes the conditions under which foreigners can get concessions. The principal requirement is to submit themselves to the provisions of the Mexican laws in all matters related to the concession. All details are fully covered in the law for foreigners (Ley de Extranjeria), officially known by the name of Organic Law (Ley Organica) of Sec. 1 of Art. 27 of the Constitution and in the regulation of the same. Individuals and foreign companies, as such, cannot obtain concessions, except when they submit to the provisions of the law on this point.

The law defines what are considered mineral industries, to wit: the discovery of the vein and the working of it, and the transport, storage, and beneficiation of ores. In accordance with the foregoing, the law has the novelty of providing concessions for beneficiating plants and for roads for industrial transport, for public as well as private use. It reserves the right of preference for obtaining concessions in the same manner as the law just annulled; but this principle is one that practice has shown to be most efficacious and equitable for giving equal chance to those who wish to secure concessions for utilizing the mineral resources of the nation.

It establishes a period of two years for concessions for exploration, continuable from year to year up to five, at the end of which must come either a concession for mining or surrender of the claim. Under the concessions for exploration the ore found in the course of work cannot be disposed of, but the beneficiary can obtain a mining concession at any time during the life of the concession for exploration. A mining concession can be obtained without the necessity of making a petition for exploration, because evidence of the existence of some mineral substance and the possibility of its industrial utilization are taken for granted from the moment at which the concession for mining is asked.

For mining concessions a period of thirty years is fixed, but at the end of this period the concessionaire has the right to obtain a new concession, the invested capital being thus secured for an indefinite period. The action of the administrative authority in these cases is perfectly defined in the law. Provided one has complied with the stipulations that the law sets forth, a new concession cannot be denied. A beneficiary who at the end of the thirty years is in possession of his concession has an indisputable right to have a new one granted, inasmuch as he must have complied with the obligations or otherwise the concession would have been declared "caduca" (forfeited).

The concession for mining has as a primary condition the obligation of establishing regular operations, and this requirement is met by a specified production per unit of surface. This unit varies according to the mineral substances exploited and also according to the distance from the general routes of communication and the size of the claim.

A mining concession is granted with a maximum surface of 100 hectares, but the law does not limit the number that an individual or a company can hold. In order to produce the required minimum the grouping of any number of mining concessions adjacent to each other up to ten may be authorized, and the stated production can be obtained from a single claim, the others being considered as reserve.

There cannot be more than one concession for the same ground; and titles which are issued are perfect, providing the concession has been granted according to the laws covering it.

Concessions for establishing beneficiating plants, transportation roads, and storage facilities are something new, having their origin in the desire that the new legislation should cover all phases of the mining industry and in the intent that these should share in the rights connected with every concession. Taking into account the public interest, installations cannot be dismantled without the permission of the administrative authority.

The law, with the object of facilitating the development of the industry, provides that within the territory of a mining concession the concessionaire can establish beneficiating plants, transportation roads and storage facilities without the need of a special concession.

In case of mineral allotments of considerable value and susceptible of immediate exploitation, where the respective concessions, granted in accordance with earlier laws or with the Law of Mineral Industries, have gone "caduca," special conditions have been established for granting concessions. The reason for this is plain: a source of riches already discovered is dealt with, something real and not merely speculative, which in view of the peculiar nature of the mining business is in most cases problematical.

Considering the characteristics which a concession established under the Law of Mineral Industries presents, it was necessary to fix certain guarantees, to insure the fulfillment of the obligations of the beneficiary. These deposits vary with the class of materials being exploited and with the distances from the lines of communication at which the mines are found, and are based on a fixed sum per hectare, which increases with the surface area of the claim.

In referring to taxes, the law clearly states that the levying of these shall rest exclusively with the federal government, thus eliminating possible conflicts with the states in this respect.

The law creates the "Public Register of Mineral Industries," with equal standing to that of the Great Register of Surface Property," the purpose being to eliminate all uncertainty as to individual rights by providing records that serve as indubitable means of proving. This should satisfy a great need.

The circumstances in which mining enterprises retain rights acquired before the new laws became effective may be summarized as follows:

Mining concessions the titles to which were issued in accordance with laws prior to the Law of Mineral Industries retain their rights and do not need new titles to continue operations. Such concessions lapse only in accordance with the provisions of the law which served as the basis for granting them. They are at the same time included in the new legal rules relating to penalties; to the proportion of Mexican employees and workmen in relation to foreigners; to previous permits of the administrative authority, to enable them to cross the boundaries of their concessions; to inspection; and to the obligation to receive engineering students on their property. Finally, they remain subject to registration. It is maintained that they contain nothing retroactive.

Beneficiating plants in existence before the passage of the law are required only to present a manifest within one year to escape the application of the law. They are required to make necessary installations for the disposal of tailings, with the object of avoiding damage to a third party; and to afford safety and health to their workmen.

The rights to prospect for and mine minerals that formerly belonged to the owner of the ground are confirmed to any applicant without cost, the title being issued in accord with the new legal regulations.

Early Zinc Smelting in Arkansas

By Tom Shiras
Mountain Home, Ark.

THE RUSTY REMAINS of a large boiler, parts of an old engine, and a hole in the ground, at Calamine, in Sharp County, Ark., mark the location of one of the earliest attempts at zinc smelting in the United States. A force of three hundred men were employed in mining and smelting operations there in the early history of the industry, and the camp was one of the busiest places in the state. Local investigations of this operation were rather unsatisfactory, because fancy had become tangled with fact, but I am indebted to C. E. Siebenthal, of the U. S. Geological Survey, for much of the following information.

The first operations at Calamine, Ark., were conducted by the Independence County Mining Co., in 1857. Old-timers at and around Calamine cling to the idea that a considerable amount of zinc was smelted at that time, but there is no authentic record of any having been produced. Evidently the venture was not successful, and financial difficulties followed. A list of property in the Chancery Court record dated June 2, 1858, includes among mining tools and other things the following: "Engine and boiler, two blowing cylinders, one condenser, ten metal molds, three hundred tons of zinc ore, and three thousand bushels of coal."

This apparent failure did not discourage these hardy adventurers in zinc. In 1867 the property passed into the hands of the American Zinc Co. and in 1869 pioneer attempts at zinc smelting in the West began.

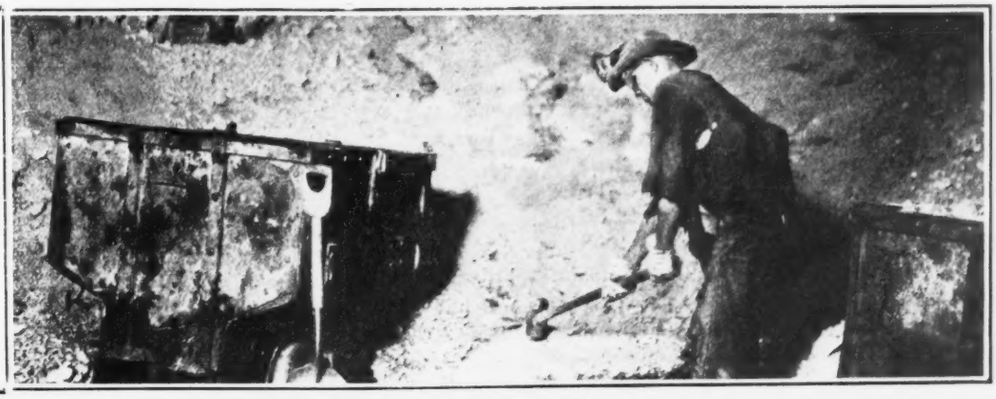
A large force of miners was employed, machinery was shipped in via the Mississippi and White rivers and carted miles over almost impassable mountain roads, and several orebodies were opened. The first experimental work at smelting was done with Professor Thoma's patent furnace, in which the retorts were placed in the bottom of the furnace for the purpose of economizing breakage. One hundred tons of ore was shipped from Calamine to New York for experiments in February, 1871. This shipment was delayed at the mouth of White River, because it was packed in boxes too large for easy handling on the boat. Evidently some of this ore reached its destination, for the agent at the mine was cautioned to use the utmost economy until the furnace had been proven, because the retorts did not stand up under the heat.

In November, 1871, sixty-one tons of ore was shipped to Hesselmyer, at Carondelet. Freight and loading amounted to $466, and the New York office remarked shortly after, in a letter, that "the cream of the profits in the zinc industry was in the smelting."

Immediately after this bricks were made at Calamine for the smelter, the erection of which was in charge of Louis Goes. One thousand tons of ore was on hand by the time the smelter was ready for operation, and on Jan. 30, 1872, two slabs of spelter were sent to New York by express. The New York office was also notified that the works had on hand at that time about one-half ton of metal and about a ton of blue powder. The manager also reported that it was feasible to smelt zinc ore by charcoal. On Feb. 17, 1872, the first shipment of metal was made, and the smelter was turning out 1,000 lb. of spelter daily. The smelter consisted of one block of two furnaces, having 112 retorts, and was operated spasmodically for about six months. During that time it was in charge of John Viehle, who in 1915 was superintendent of the Edgar Zinc Works, at Carondelet, Mo. The total output of the plant was 126 tons.

Safety First

This shoveler in the Tri-State zinc-lead district uses goggles to protect his eyes when sledging.



Treatment of Roaster Flue Dust

Wet Method Suggested for Such Undesirable Byproducts

By G. Newton Kirsebom
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FLUE DUST, especially when it is of a complex nature, offers many difficulties to the smelter metallurgist. It is one of the undesirable byproducts that is too valuable to throw away and yet often of such physical and chemical characteristics that it is difficult to find a place for it in the smelting charge, so it is sometimes merely stocked in the hope that a profitable means of utilizing it may be developed with changed conditions. Such a stock of about 20,000 tons of baghouse dust accumulated at a plant in which I was interested, that was closed down owing to mine exhaustion. It was essentially a zinc material, for the treatment of which the company had put up a small experimental plant that had given the operators some experience in the electrolysis of zinc. Its analysis was approximately as follows: Lead, 7 per cent; zinc, 14; bismuth and copper each 0.5 per cent; arsenic, 8 per cent; and silver, 10 oz. per ton.

The lead was present largely in the form of sulphate and the zinc as a basic sulphate, so a wet method of treatment was indicated. Several methods were tried, of which leaching with roaster gas seemed the most promising. Mixing the dust with weak sulphuric acid. and passing a gas containing from 1 to 2 per cent of sulphur dioxide through the pulp, resulted in the solution of practically all of the zinc that was in the form of sulphate. The sulphuric acid alone did not give nearly so good results, indicating that the sulphur dioxide was the important factor in the solution. It was possible, by using small amounts of solution, to bring the zinc sulphate up to a concentration suitable for electrolysis. Unfortunately, all the arsenic went in. solution, along with smaller amounts of iron, a condition that proved first to be a great stumbling block. To oxidize all the arsenic by artificial oxidizers, such as permanganate, was far too expensive, and any other way of separating the two metals seemed at first impossible.

Finally it was found that by adding a solution of barium sulphide slowly to the solution it was possible to precipitate out all the arsenic as sulphide, along with some barium sulphate, leaving the zinc sulphate practically untouched. The heavy precipitate of arsenic trisulphide and barium sulphate could now be mixed with powdered coal and heated in a furnace, from which fume of arsenic trioxide was recovered, at the same time as the barium sulphate was reduced to barium sulphide, which could be used over again in the process. The remaining zinc sulphate was then purified by usual methods and electrolyzed. Barren electrolyte was used partly for repeated leachings, along with the sulphur dioxide gas, and partly as acidifier in the subsequent brine process.

The residue was now leached with hot acidified brine, throwing the lead, bismuth, copper, and silver into solution as chlorides. The lead chloride was precipitated by cooling and treated separately, being melted down with lime and pulverized coal, giving pure lead and a slag of calcium chloride which was used for purifying the brine solution in the cycle. All of the other metals in the solution were precipitated with sponge iron, giving a metallic residue of lead, silver, copper, and bismuth, which could then be treated to recover the various metals. The residue after the brine leach was worthless and could be thrown away.

The process looked profitable on paper under the existing conditions, and it was practically decided to go ahead, when the slump in arsenic set in. Even so, the process might have been profitable had it not been for the fact that only 20,000 tons was available, so that it would not be possible to write off the invested capital by the time the material would be exhausted. Under the conditions, the scheme was abandoned and a good opportunity was lost for trying out a wet treatment of a complicated flue dust on a working scale. This has not been done so far in this country and for several reasons.

To the smelter superintendent, flue dust is an obnoxious and unpleasant byproduct, an economic burden, for the treatment of which he does not like to place heavy investments, and the result is that each plant treats its flue dust in a humdrum way. This is particularly the case with flue dusts from roasting and sintering furnaces, baghouses, or Cottrells. In some places the dust is stirred up with water, allowed to dry up and harden in irregular lumps, and then mixed with the blast-furnace charge. At other plants the dust is wetted with water and compressed in a briquetting machine, the briquets being allowed to harden in the air for several days. In both operations the labor expense is heavy. Briquetting of the dust costs anywhere from 80c. to $1.20 per ton, this being mostly for labor. With the increase in roaster dust, due to the changed conditions resulting from selective flotation, this expense will no doubt rise considerably in the future unless an adequate method of treating the dust is discovered.

As is natural to a smelter man, any wet process is rarely considered. A wet process installed in connection with a smelting plant calls for men trained in hydro-metallurgy, and a smelter superintendent, being used to large and quick returns, looks with impatience on a process in which the investment is large compared to the daily output.

Most of the experimental work carried out at various plants has been in an effort to improve the mechanical treatment of the dust. To eliminate labor was the chief aim; tests have been carried out from time to time in which the labor in briquetting was supplanted by mechanical apparatus. "Nodulizing" the dust has been tried several times. It was wetted in a mixer, mechanically charged into a revolving furnace or drum which was slightly heated inside from a coal fire below, and small nodules of the dust would then come out from the lower end of the furnace. The principle is the same as in briquetting, except that the method described is supplanted by the rolling action of the furnace, heat

being at the same time supplied to cause the nodules to dry up and harden quickly. Nodules could usually be made, suitable for charging into the blast furnace, but the percentage of loose dust was considerable and there was also trouble in keeping the furnace from clogging. Additions of small amounts of lime or sodium carbonate to the dust have, in certain cases, proved beneficial in giving larger nodules and lowering the amount of dust formed. In carrying out such a test I also found that the nodules coming out of the furnace wet would dry and harden very quickly by being subjected to a rolling action on inclines before reaching the bin.

Research on Dust Constituents Should Precede Experiments

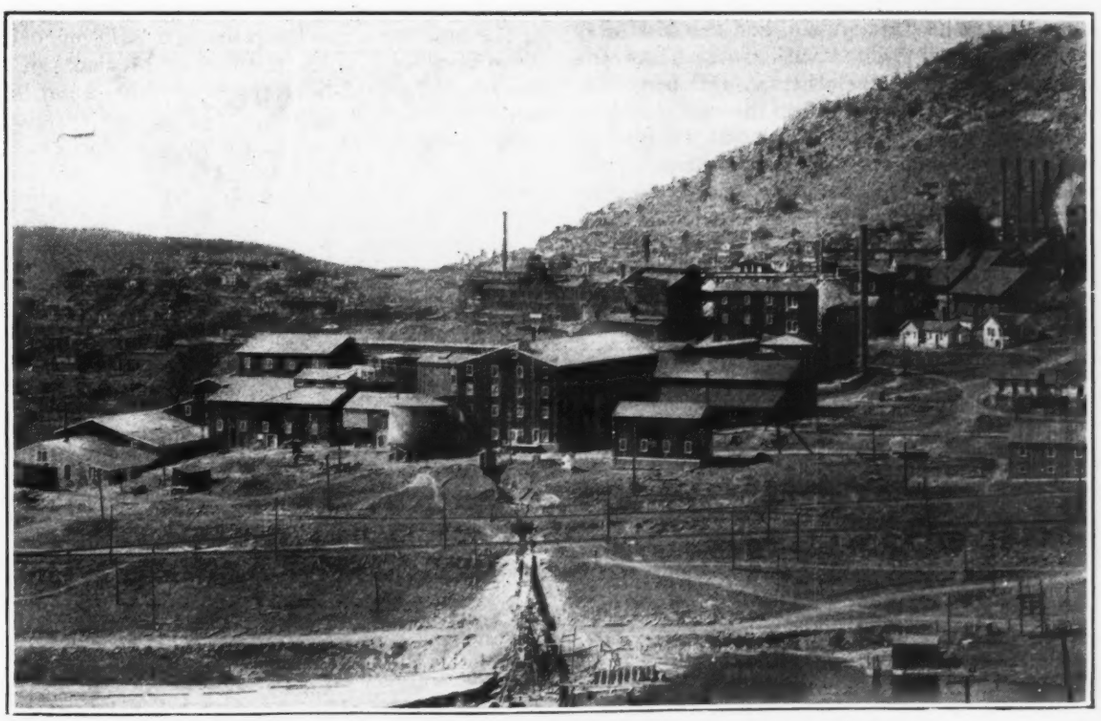
An intelligent research in the determination of the chief constituents of a certain dust and their relation to one another, and then on the effect of adding various amounts of cheap ingredients that would tend to ball the dust together and cause a quick hardening and drying of the product, would be constructive as a guide in such experiments. There is hardly any doubt that mixtures could be found to suit the different conditions, and the mechanical difficulties should not be insurmonutable, considering the saving in cost. Such nodulizing, even with the use of small amounts of sodium carbonate, could be carried out easily for less than half the cost of briquetting.

Considering now the wet treatment of roaster flue dust, it is probable that this is the road along which the final solution to the question will be found. So far, experiments have been carried out only in a small way. We know that most of the dust produced in lead smelters carries more or less zinc and arsenic besides lead and precious metals. We also know that by making a wet pulp of the dust, and passing roaster gas through it, it is possible to dissolve out the first two elements mentioned. The zinc content will in the future be insignificant and scarcely worthy of recovery. But by applying the barium sulphide process to the solution obtained, and roasting the resultant precipitate, a refined arsenic can be produced at once with only the extra expense of reducing the barium sulphate to sulphide with pulverized coal. A short cut is thus made in the recovery of arsenic at the smelter, saving the blast furnace from this unpleasant element, obviating the formation of speiss, and giving a blast-furnace dust high in cadmium if this metal be present. It will, of course, also reduce the amount of blast-furnace dust to be treated and eliminate entirely the costly process of refining arsenic from crude.

The residue from the sulphur dioxide leach could be properly treated by subjecting it to a brine leach. There has been much unpleasant experience where ores have been treated by a brine leach, especially on account of the excessive deterioration of equipment. However, flue dust, being a byproduct and in a fine state of division, lends itself more readily to brine treatment than any oxidized ore, which must undergo several stages of preparation. As to the materials used for containers, the good results obtained in the use of sulphurized concrete and similar material produced by the sulphur companies in the South should offer a solution to this feature of the problem.

Topographic Surveys of the United States

The total area of the United States, exclusive of Alaska, topographically surveyed by the U. S. Geological Survey, was 1,280,919 square miles, as of June 30, 1926. This is equivalent to 42.3 per cent of the total area. During the year ending June 30, 1926, a total of 15,535 square miles was surveyed. The following states have been completely surveyed: Connecticut, Delaware, Maryland, Massachusetts, New Jersey, New York, Ohio, Rhode Island, and West Virginia.



Cyanide plant of Portland Gold Mining Co. at Victor, Colo.

Marble Quarrying in Talladega County, Alabama

Commercial Deposit 125 Ft. Thick With 40 Deg. Dip—Polishing and Carving Done Near Quarry

By Albert H. Fay
Assistant Editor

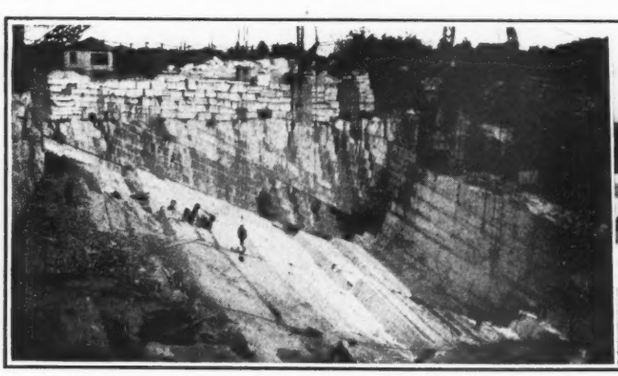
THE Alabama Marble Co., Gannts Quarry, Ala., about three miles from Sylacauga, has been operating continuously for twenty years on a marble deposit in Talladega County, 50 miles southeast of Birmingham. This marble is 200 to 225 ft. thick and dips 28 to 40 deg. About 125 ft. of the lower part of the bed is of commercial grade, all of which is white. The company not only sells marble according to specifications, but takes contracts for the entire marble work in large buildings, wherein it actually sets the marble that it produces from its own quarries.

These deposits are in the southeastern part of Talladega County and extend southwest into the northern part of Coosa County. Near Sylacauga the marble bed outcrops and is "named"[1] the Sylacauga member of the Talladega slate, and extends from a point a mile northeast of Marble Valley, in Coosa County, to the McKenzie quarries, 4 miles southeast of Talladega, and probably a few miles further to the northeast. The marble is a fine-grained, white or cream-tinted translucent rock, more or less clouded with green from thin layers of green phyllite within the limestone. It is used for interior finish, exterior construction, and statuary. Marble from these quarries contains 96 to 99 per cent calcium carbonate. By careful work it is possible to obtain blocks 3 to 5 ft. in thickness and 20 to 25 ft. long.

The marble is quarried by aid of channeling machines, producing blocks about 5 by 8 by 10 ft. These blocks are transferred by rail to the sawmill, where 24 gang saws and one 76-in. diamond saw are operated. The saws are of steel, without teeth, and the cutting is done by fine silica sand applied with water under the steel blade. The saws cut about ½ to 1 in. per hour, so that a 5-ft. block may be under the saw continuously for from two and a half to five days. These saws produce slabs of any desired thickness, the most common being ⅞ in., which will dress to ¹³⁄₁₆ in. These slabs range in size from 5 by 6 ft. to 8 by 10 ft. and are transferred by crane to the grinding and polishing room, where they are rubbed, polished, or otherwise finished for setting in place. Where any of the slabs have color designs in them, the slabs containing a particular pattern are kept together, so that they may be arranged in an artistic manner in the building wherein they are to be placed. Following the polishing, the slabs are cut in specified dimensions for use as base trims, window casings, wainscoting, and other decorative purposes. Larger-dimension stock of 3 by 4 in., used for balusters or stair rails, is also trimmed, cut, and polished according to specifications. But little of this material is cut for stock, because the architect on each large building supplies his own specifications. About the only material kept in stock is the undressed ⅞-in. slabs as they come from the saws, which may be polished and cut according to specifications. The dimension cutting is done by circular carborundum saws, apparently as easily as the ordinary saw cuts through an inch board. Much of the marble is turned in lathes, but a large part is hand-carved with air machines to conform to the architect's drawings. The marble company prepares plaster casts of the design in conformity with the architect's drawings and the casts are submitted to the architect for his approval. After the approval has been received the cast then serves as the pattern by which the carver proceeds to cut the marble and to dress and polish it.

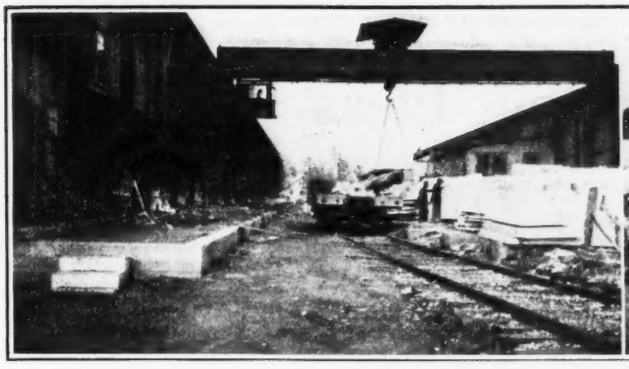
One of the important factors in the conduct of the marble operation is the packing and shipping of the product after it is cut. As each piece is cut and marked at the mill for a specific place in a building in Chicago, New York, or Boston, the loss or breakage of a single piece, large or small, is of considerable financial importance, not only because of the cost of preparing the piece by skilled labor, but for the additional reason that its loss might cause serious delay in the completion of the job. Large slabs are usually packed by setting them on edge in box cars, putting excelsior around them, and bracing them securely in the cars. For local shipment, in small lots, all pieces are thoroughly crated, the crates being so constructed that they carry the

[1](Special Report No. 14, "Geology of Alabama," page 51 Geological Survey of Alabama, 1926).

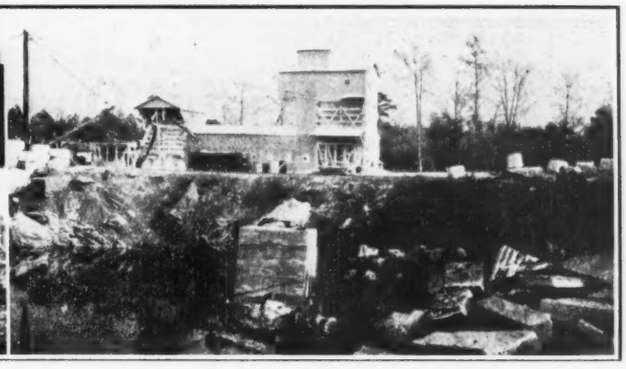


Quarry of Alabama Marble Co.

Marble blocks ready for transportation to sawmill



Sawmill at left; polishing plant at right



Temporarily abandoned quarry with crushing plant above

slabs on edge. Small pieces are packed in strong boxes with all spaces tightly filled with excelsior. The boxes are anchored in the car in such a way that they cannot move while in transit.

All of the machinery in the mill and the channeling machines at the quarry are electrically operated. All sawing, grinding, and polishing is done wet, so there is no dust to injure workmen. As for labor, all in the mill is native white, including the carvers. At the quarry all machine men and hoisting men are native white, only a few colored men being employed as unskilled labor.

Labor turnover is small, many of the men having been with the company fifteen to twenty years. The most skilled labor (carvers) has been developed at the mill through a system of apprenticeship. The native white labor is of a high class and develops into good artisans, independent of labor unions. While wages are not so high as in northern industrial centers, living expenses are lower. House rent, including light and water, is about $2 per month per room. The climate is mild, thus making it possible to dispense with heavy clothing required in northern climes. About 300 men are employed.

In quarrying and preparing the marble there is a considerable waste of pure white marble. A mill is maintained for crushing and screening this material. Some of the products are: water-ground whiting, 90 per cent through 350 mesh; chicken grit, about $\frac{1}{16}$ in. in size; terrazzo, Nos. 1, 2, and 3, sizes respectively $\frac{1}{4}$, $\frac{3}{8}$, and $\frac{1}{2}$ in.; Italian mosaic, $\frac{3}{4}$ by $\frac{3}{4}$ by $\frac{1}{2}$ in.

Material below 20 mesh is also marketed for various uses. The amount of material thus disposed of as by-products, however, is not as large as the amount of waste material that is produced at the quarry and mill.

In addition to the quarry of the Alabama Marble Co., there are two other quarries in operation within a mile or so of this property, the Madras Marble Co. and the Moretti Harrah Marble Co., both of Sylacauga, Ala. The quarries of all three companies are as yet comparatively shallow, but depth will be gained very rapidly as quarrying proceeds down the deep dip of the marble. At present the overburden is about 50 to 75 ft. of heavy clay, which is removed by steam shovel or clamshell scoop.

The Alabama company has one old underground quarry that is temporarily used for water storage. This quarry extends 300 ft. from the portal, and the face is over 200 ft. below the surface. It is anticipated that this quarry will again be opened, but all work is now concentrated on opening another underground quarry by driving four 80-ft. tunnels or slopes. Pillars 20 ft. wide are to be left to support the overburden.

Output and Profits of Rand Mines

The record for gold output in 1926, of the half dozen leading mines of the Rand, according to *The Mining and Industrial Magazine*, is as follows:

	Total Revenue From Gold Produced
Government G.M. Areas	£4,312,235
Crown Mines	3,508,737
New Modder	3,488,484
Randfontein Estates	2,446,066
City Deep	1,739,902
East Rand Proprietary	1,687,525

The most productive mines are not necessarily the most profitable. The factor of grade comes into the question, as is shown in the following table, which lists the leading profit earners:

	Total Estimated Profit
Government G.M. Areas	£2,484,817
New Modder	2,064,859
Crown Mines	1,045,468
Modder Deep, Ltd	786,955
Springs Mines	742,566
Brakpan Mines	665,068

The Witwatersrand again easily maintained its supremacy as the most productive gold field of the world by a substantial margin. Last year's output was 9,962,852 oz., in value £41,773,159, compared with 9,346,697 oz. and £39,702,245 for 1925, and represents just over 50 per cent of the world's output.

The mines of the Rand paid in dividends for 1926 a total of £7,978,158, which is a decrease of £186,009 from the total for 1925, which was £8,164,167. It will be recalled that 1925 revealed a decrease in dividends of £1,380,360, so the total for 1926 is some £1,566,350 below that for 1924, which derived a huge benefit by the inclusion of £425,000 arrear dividends of Robinson Deep A.

The feature of 1926 dividends is the advance from 13s. to 14s. 6d. per share in the total distribution of Government Areas, whose rate for the final half year is 8s. This means an extra £105,000, and brings the distribution to just over a million.

New Modderfontein is, however, still well ahead, with £1,610,000, the same as for the previous year, or £595,000 more than the distribution by Government Areas. The newer mines of the Far East Rand have done well, with the exception of Van Ryn Deep, which pays £60,000 less. New Modder itself, Modder Deep, and New States repeat their dividends of the previous year, and Modder B pays £35,000 more. The great Randfontein Estates is the disappointment of the year so far as dividends are concerned, for though it managed to pay 5 per cent in 1925, involving £203,000, in 1926 it paid no dividend.

Useful Operating Ideas

Tongs for Making Clay Dummy Cartridges for Tamping

In general, clay seems to be the most satisfactory stemming material, but difficulty is often experienced in its use when it is simply rolled into balls or long dummies, according to C. S. Hurter in the Du Pont *Explosives Service Bulletin* for February. After a number of these have been rammed into the bore hole, the clay puddles under the action of the tamping stick, works around it, and becomes plastered on the sides of the hole, so that no further progress can be made. To avoid this trouble the clay should be made up into paper-covered dummy cartridges, but this is not an altogether easy thing to do. Paper shells or tamping bags can be easily filled with sand or fine dirt, but putting clay into a paper shell is a different matter. For this purpose, the Montreal Mining Co., of Montreal, Wis., a subsidiary of Oglebay, Norton & Co., which has a good plastic clay available, has developed special tongs which have been found to be very successful and economical. These tongs, which are shown in Figs. 1 and 2, consist of an 8-in. length of 1½-in. pipe split lengthwise, hinged and fitted with handles so that the two halves can be opened and shut.

The wrappers are made of heavy paper similar to that used for dynamite cartridge shells—often the lining paper from the dynamite cases—cut in the shape of a trapezoid 10 in. long, 6½ in. wide at one end and 8¾ in. wide at the other, as shown in Fig. 3. A piece of paper so cut is laid on top of a level bed of clay, the tongs are held in an upright position with jaws wide open resting on the paper so that the length of the jaws is parallel to the 10-in. edge of the paper. The jaws are pressed down hard and then closed. This picks up

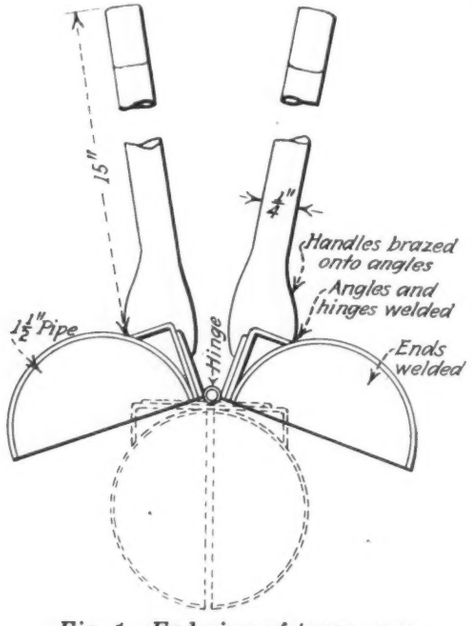


Fig. 1—End view of tongs, open

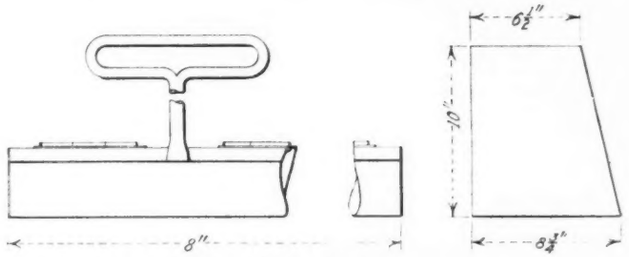


Fig. 2 (left)—Side view of tongs, closed
Fig. 3 (right)—Paper cut to proper dimensions

inside the paper a mass of clay 1½ in. in diameter and 8 in. long. The tongs are opened, paper and clay are removed together, the paper is wrapped around the clay, turning in the straight edge first, and the ends are folded over. This makes a soft plastic cartridge. In loading these dummies, the paper can be slit and the clay rammed home as compactly as the most plastic gelatine without any puddling of the clay by the tamping stick.

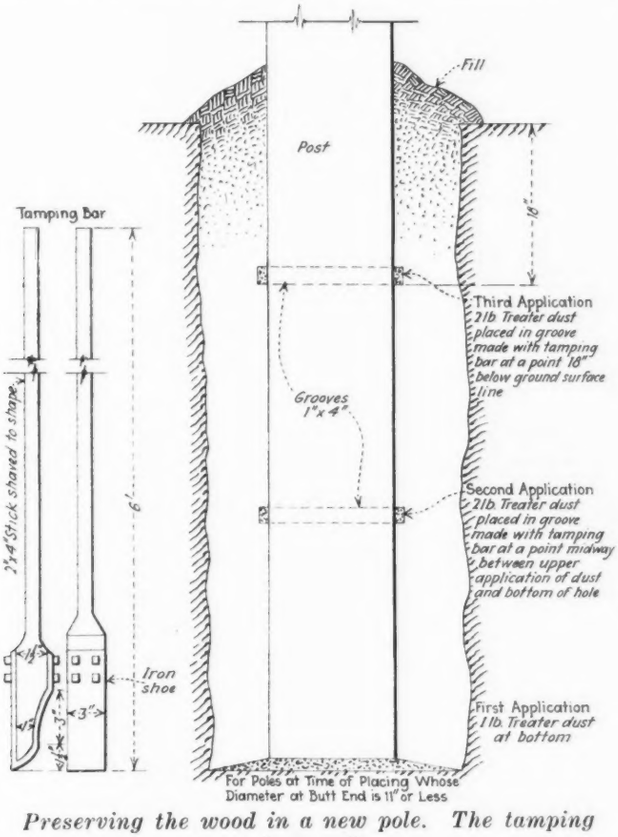
It will be noted from Fig. 1 that the hinges on the cartridge mold are so arranged that the handles are together when the mold is open. This is necessary so that the jaws can be pushed down into the clay without bending the handles. Tongs of this design can easily be made by a good machine blacksmith.

At the mine where these tongs were invented, one man working three and one-half hours has made 320 dummies, including cutting the wrappers, squeezing the clay into the mold, and wrapping the paper around the clay. At this rate one man should be able to make 640 dummies in an eight-hour day, allowing one hour for filling the clay bin and handling boxes of finished dummies. The work of making the dummies has been done sometimes by one man, sometimes by another who was available in intervals between other work. If the same man were kept on this job continuously he would, doubtless acquire greater skill and be able to make a greater number of dummies per hour.

New Timber Preservative

The use of cold treater dust, having a high arsenic content, as a timber preservative where timber such as transmission poles, fence posts, and other wooden structures coming in contact with soil are to be preserved has recently been developed by the Anaconda Copper Mining Co. The method has the advantage of low cost. Apparently the dust sterilizes the soil in the immediate vicinity of the wood and penetrates the wood as well. Its slow solubility prolongs the beneficial action. It is placed at the bottom of the pole and in one or more rings immediately surrounding the pole. As the dust is poisonous, it is necessary to prevent it from getting into cuts, open sores, or scratches. Gloves should be worn when handling it and care taken to avoid its getting into eyes, nose, or mouth. Water which may be in the pole hole should be bailed out. In apply-

ing the dust to a pole in place, the ground is excavated to a depth of 25 in. and the pole freed from all decayed wood. The hole is then backfilled to a depth of 20 in. from the ground line. A special tamping bar is then used to make a groove 1 in. wide and 4 in. deep completely around the pole at this depth. The groove is filled with 2½ lb. of treater dust. Fresh dirt is then placed for an additional depth of 10 in. without tamping and then backfilled to a point 10 in. below the ground line, when another ring of dust is placed as in the first instance. Fresh dirt for a distance of six inches is placed above the second ring of dust, and the hole backfilled and tamped. In placing new poles one pound of treater dust is placed in the bottom of the hole and two rings, each of two pounds of treater dust, are placed above the bottom as shown in the accompanying sketch.



Preserving the wood in a new pole. The tamping bar used

Preventing Lead Poisoning in Mining

The prevention of lead poisoning in mining resolves itself into two separate but allied sets of responsibilities, those devolving upon the company and those devolving upon the employees, the U. S. Bureau of Mines points out. The company responsibilities are primarily to maintain working conditions in which the lead hazard is reduced to the lowest degree possible by observing the following precautions:

Underground drilling to be wet.

Piping an adequate supply of water to all working faces.

Sprinkling muck piles thoroughly before loading.

Blasting only at end of shift.

Adequately ventilating every working place in the mine.

Company responsibilities not only require that facilities be provided for carrying out these precautions, but that through strict supervision proper uses be made of these facilities by employees, so as to keep the mine atmosphere as free from dust as is possible.

Having reduced the lead hazard to the lowest possible point at its source, the company has the further responsibility of providing measures such as the following to offset any exposure to lead as may still occur: A good change house having plenty of hot and cold water, with an average of one shower to every ten employees; a good medical service, including periodic examinations of all employees by which men showing the least suspicion of lead absorption can be placed under observation and treatment at the earliest possible time; shifting men showing suspicious signs of lead absorption to sections of the mine with less lead hazard, or to surface work; and education of employees as to the ways and means of warding off lead poisoning.

The responsibilities of the employees are, first, cordial co-operation with the company in its efforts to limit the lead hazard underground; and, second, the practice of certain rules of personal hygiene and habits, including:

Keep body clean.

Bathe at end of each shift and change to street clothing.

Change and wash work clothes frequently.

Wash hands before eating.

Never eat food in a dusty atmosphere.

Rinse mouth before eating.

Eat a substantial meal before reporting for work.

Eat plenty of nutritious food.

Keep body excretions free. Do not permit yourself to become constipated.

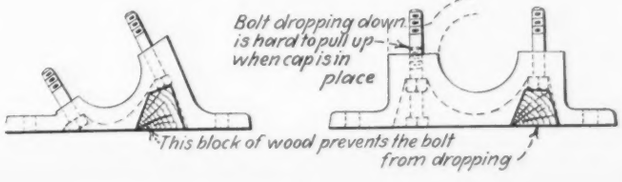
Avoid all excesses, particularly alcoholic beverages.

Consult company physician at first sign of ill health and report for periodic examinations regardless of how well you feel.

How to Keep Bearing Bolts in Place

By Charles Labbe
Clarkdale, Ariz.

Many large bearing boxes, of the straight or angle type, have the recesses for the bolt heads cored to a height that will permit of the use of short bolts. When the cap is removed the bolts drop down to the sole plate. On replacing the cap, the bolts have to be "fished" out with a wire or string—sometimes a tedious and uncertain operation. Wedging the bolts in the bolt holes is not particularly successful, as they may be either out of line or may be driven back accidentally. A better plan is to fit blocks of wood in the recesses under the bolt holes before putting the bearing in place, as shown in the accompanying figure. These will hold the bolts firmly in place and keep them from turning in case the nut does not screw on easily.



Discussion

Utilizing Native Steam in Japan

THE EDITOR:

Sir—In your issue of Dec. 18, Vol. 122, No. 25, page 962, in an editorial, you discuss the occurrence and use of "native steam" in Italy and in California, stating "this is the only known enterprise of its kind." Allow me to correct you.

Last September I visited a gold mine on the island of Kyushu, Japan, and on my return was obliged to remain one day in the city of Beppu, on that island. This place is noted for its hot springs, of which there are very many, and of all kinds, from small puddles filled with what looks like boiling cement to large ponds supplied by steaming jets of considerable volume. In some of these grotesque figures allow the steam to issue from mouth, ears and nose, and the pressure is such that the hissing sounds can be heard for some distance.

I mentioned to my interpreters the activities in Italy and California in this line, and to my surprise was informed that such a plant had been installed in Beppu. A wealthy citizen had done the development work and it was now awaiting further exploitation. After some inquiry we obtained permission to inspect the plant. In a small house about 20 by 40 we found the installation.

On our arrival the steam was issuing from a 1-in. pipe placed through the roof, and the hiss indicated considerable pressure. The plant consisted of a small rectangular mound-like lump of insulating material, in which was contained most of the "works"; as near as I could ascertain through a non-technical interpreter this was a multitubular boiler of quite ordinary construction and filled with fresh water. The "native steam" was used in this boiler to heat the water, and the steam from the boiler was used to drive a small turbine and electric generator. The attendant closed the waste pipe slowly and allowed the steam to enter the boiler, the gage promptly going up to only 12 lb. In about twenty minutes the boiler pressure had also attained that point, and he then started the turbine, resulting in the lighting up of the many electric lamps hung about the shop.

The boiler is used because of the corrosive effect of the steam upon the blades of the turbine. The presence of H_2S and SO_2 is plainly evident to the chemically trained nose, and there are no doubt a number of other gases contained.

It was a natural question to ask why the turbine was not run condensing, to gain the further atmospheric pressure, and the answer was that no cold water is obtainable in the region, as every well, deep or shallow, produces warm or hot water! The well was drilled by a hand-operated "spring-pole rig," is said to be about 300 ft. deep and of 3 to 4 in. diameter, and cased only near the top, I believe.

The question of greater pressures at greater depths is to be tested when the new company takes hold.

Kuji, Iwate-ken, Japan. JAMES W. NEILL.

Kernite or Rasorite?

THE EDITOR:

Sir—In a recent issue you published an article by Hoyt S. Gale entitled "A New Borate Mineral." Another article on the same mineral by Dr. William T. Schaller appeared in the January number of the *American Mineralogist*. In both of these the mineral is referred to as "kernite," the name being given to it because it was found in Kern County, Calif.

The only deposit of this mineral known to exist is near Kramer, Calif., on the Associated claim of the United States Borax Co., a subsidiary of the Pacific Coast Borax Co. When the tests made in the company laboratory demonstrated that it was in fact a new mineral the name "rasorite" was given to it, this being in honor of Mr. Clarence M. Rasor, field engineer of the company, under whose direction the Kramer deposit has been opened up and explored. As this name was bestowed upon it before either of the articles mentioned was published and as it has the sanction of the owners of the only deposit of the mineral that is known to exist, it would appear that rasorite is the authentic name for the new mineral.

In justice to Mr. Gale and Dr. Schaller it should be stated that this name has not been made public heretofore, nor has the company given out any information concerning the discovery near Kramer. So far, only one person not an officer or an employe of the borax company has been allowed to examine this deposit or take samples from it. The only portion of these samples which left his possession went to the geological department of an Eastern university, so that it is apparent that those which eventually found their way to Mr. Gale and Dr. Schaller were, so to speak, originally "bootlegged."

In passing, it might be mentioned that this deposit has yielded another very interesting mineral in the form of a perfect satinspar pseudomorph of ulexite.

San Francisco, Calif. LEROY A. PALMER.

The Coronation Mine

THE EDITOR:

Sir—On page 373 of the Feb. 26 issue of the *Engineering and Mining Journal*, under the caption "Coronation Completes Mill," it is stated that, "The Coronation mine, Field, B. C., on Cadwallader Creek, in the Lillooet mining division," and so on. The location of this property as being at Field, B. C., is an error, as it is some 300 miles in an air line from Field to the mine, which latter is (that is, the Coronation mine) about 40 miles in an air line a little north of west from Lillooet, a town on the Fraser River and on the Pacific Great Eastern Railroad. Field, B. C., is a station on the Canadian Pacific Railroad, in the Canadian Rocky Mountains, not far from the British Columbia-Alberta boundary line, and is in the Golden mining division.

Vancouver, B. C. NEWTON W. EMMENS.

Consultation

Uses of Bentonite

"Can you give some information on the practical applications of the material called bentonite in the industries or arts?"

The principal use of bentonite is as a substitute for fuller's earth in the refining of petroleum. For this purpose large tonnages have been mined in recent years in California. A. G. Van Eman, of Cheyenne, Wyo., says that, although the commercial utilization of bentonite, outside of the petroleum industry, has progressed slowly, the possibilities of the material have attracted increasing scientific attention during recent years. Industrial chemists are becoming increasingly familiar with the unusual properties of the product and are gradually developing new uses. Among the possible applications that have been suggested are: as an absorbent; as a constituent of cements and plasters; in ceramics, as a bonding and plasticising agent, and as an agent for suspending enamels; as a filler or loader in various products; in paints, pastes, and sizings; in soaps and detergents; in foundry operations as a suspending agent for core washes and as a bonding agent in molding sands; as a soil dressing and filling material for fertilizers; as a spreading or suspending agent in insecticidal sprays and dips; in the pulp and paper industry as a co-agent with paper fillers to increase retention, and as a suspending agent for carbon black in de-inking news print; as an emulsifier for oils, asphalts, and similar substances; and in various medicinal preparations.

Pumping by Air Lift

"What is the air-lift pump and to what extent is it applicable to mine pumping?"

The principle on which the air lift operates is very simple. The device consists of a delivery pipe partly submerged in the liquid or pulp that is to be raised. Compressed air is introduced at the foot of the pipe. In a delivery pipe of small diameter the air forms piston-like layers between masses of water or other liquid; in a large one the air mixes with the water, forming large bubbles. The aëration of the water reduces the average specific gravity of the column and the pressure of the outside liquid forces the aërated column to rise in the delivery pipe. Submergence is the distance below the surface of the liquid at which the compressed air is admitted. The per cent of submergence is the ratio of submergence to the total length of the delivery pipe. For efficient pumping this ranges from about 65 per cent for a lift of 20 ft., to 40 per cent for one of 500 ft.

The advantage of the system in mine pumping is the simplicity. If a compressor is available little additional equipment is required. For this reason air lifts frequently have been used for unwatering mines that have been idle for a period of time. The efficiency, however, is not high—it is in fact low—and in most instances it has been found that pumps can be substituted to good advantage for a permanent "pumping" installation.

Copper Ore Reserves

"Please give me the approximate ore reserves of the principal copper-mining companies of the world."

No estimates are published for many of the large producers, particularly for the vein mines. It is obvious that in an operation like that of Anaconda at Butte it would be impracticable to keep very far ahead of mining with development work. Accordingly, the ore actually developed in a technical sense is small. Experience has shown that an approximation of the ore that will be won from a hundred veins averaged together can be made, but there is no purpose in trying to reduce this to figures. Much the same condition exists elsewhere: that is, a published figure for ore reserves would be of little significance. However, the eighteen companies listed below have published estimated tonnages and average grade of their reserves as of the dates mentioned. Some of these are not very recent, but they may be interesting. The data are from the chart of the Copper Share Statistics Co.

Company	Date	Tons	Copper Content, Per Cent
Andes	December, 1924	137,400,000	1.51
Arizona Bagdad	December, 1922	15,921,100	1.62
Calumet & Arizona	December, 1925	1,829,546	4.15
Calumet & Hecla	December, 1925	108,143,000	1.2
Chile Copper	December, 1922	684,259,912	2.12
Consolidated Coppermines	August, 1926	20,729,135	1.55
Engels	December, 1925	2,437,608	2.00+
Granby (*a*)	December, 1925	8,896,320	1.77
Howe Sound (*b*)	December, 1925	5,643,712	2.10
Inspiration	February, 1926	96,010,935	1.40
Miami	December, 1925	67,917,514	1.01
Nevada Con. (*c*)	December, 1925	279,686,431	1.52
New Cornelia	December, 1925	57,860,351	1.40
Noranda (*d*)	January, 1926	944,525	6.7
Ohio (*e*)	December, 1923	36,000,000	0.3
Southwest Metals	December, 1921	700,000	2.75
United Verde Ex.	December, 1924	946,319	10.53
Utah	December, 1925	514,000,000	1.15

(*a*) Hidden Creek mine only. (*b*) Britannia mine only. (*c*) Includes Ray and Chino. (*d*) Also contains $5.54 per ton in gold. (*e*) Exploited by leaching *in situ*

E. & M. J. Non-Metallic Quotations

"Will you inform me how *Engineering and Mining Journal* determines the quotations of the large number of non-metallics listed in the market section in the issue bearing the date of the first week of each month?"

By telephone, direct mail communication, and questionnaire blanks, a representative number of producers and dealers in the various minerals quoted are canvassed, and the returns from the various sources mentioned are tabulated and averaged, particular importance being assigned to large transactions, the influence of which, as in the sale of all commodities, operates in considerable degree to fix quotations. As was noted, the non-metallic quotations appear monthly, as it is unnecessary to make a weekly canvass of widely scattered districts in which prices change at comparatively rare intervals. Though the two full pages of non-metallics appear only once a month, all the metals and minerals quoted are listed weekly, and readers are referred by date to the issue carrying detailed quotations. Should important changes occur, however, mention is made immediately.

News of the Week

Summary

GEOPHYSICAL PROSPECTING undertaken by U. S. Bureau of Mines—Potash drilling sites announced—"Story of Copper" filmed.

Congress mine to be reopened—Development program under way at Aspen, Colo.—San Rafael increases reserves.

Small advance in price of lead helps Idaho miners, wages being on sliding-scale basis—Kellogg zinc plant well under way—Engineers Gold ordered to produce books.

Power Estate mines sold—Sheldon enlarges old shaft—Comstock mill, Kingman, Ariz., treating 75 tons per day.

West Dome Lake mines show operating loss—Dome mines mill 43,000 tons per month—Howey Gold freighting supplies for summer use.

California Rand again on dividend basis—Many small mines developing in Alaska—Maxville Gold soon to resume milling operations.

New tin dredge for Malaya—Russo-Asiatic lost to Soviet—Lena Goldfields continues operation.

South African Platinum costs decline and appreciable quantities marketed—Imports of precious stones on increase; diamonds lead.

Harbor Improvement at Crescent City, Calif.—Five placer mines operating at Downieville.

Sulphur Bank quicksilver mine acquired by F. W. Bradley.

Gold Discovery Made at Weepah, Nevada

Volume of Deposits Not Proven —Water 30 Miles Distant

HIGH-GRADE GOLD ORE has been found on the property of the Electric Gold Mining Co. at Weepah, Nev., 25 miles southwest of Tonopah, 48 miles by road, that has resulted in a stampede from Tonopah. Practically all of the ground for miles around has been staked, and sales of some claims have been reported. The property on which the discovery was made is an old one with several hundred feet of development work. The deepest shaft is 170 ft. and is 500 ft. north of the recent discovery, which was made in a small open cut about 4 ft. deep.

On account of the limited exposure it is not possible to determine at present the strike, dip, or extent of the orebody. The exposure does show, however, some high-grade ore in quartz. No work has been done since the discovery, as the owners prefer to leave the surface showing for exhibition and advertising purposes until the company is financed for development work from the main vertical shaft. The main portion of the country rock is reported as sedimentary, and it is claimed that in the old workings a number of faces show $10 ore over widths of several feet.

Weepah as a mining district is not new, it having been intermittently worked for about twenty-five years, but nothing other than low-grade ore was ever found prior to this recent discovery. Old-timers tell of two Indians who came in from Weepah twenty years ago and showed Joe Ford, a sheep man, a sack full of rock that contained considerable gold. The Indians asked Ford to go with them to see their find, and on the way out one of the Indians is reported to have died from heart attack and the other Indian, by reason of superstition, refused to take his companion to the place where the gold had been found. Whether or not this find is the same one is not known.

Excitement over the gold strike is spreading day by day. Every train to Goldfield brings locaters, prospectors, gamblers, and adventurers of various types, bound for the new diggings. Burros, which afforded the means of transportation in the stampede to Goldfield twenty years ago, have no part in this gold rush. Automobiles cover the stretch of fair road in quick time. The tent city of Weepah is only two weeks old.

Frank Horton was the discoverer of the gold deposit, and his father is president of the Electric Gold Mining Co., on whose property the find was made. The elder Horton has been in the Goldfield district since 1904. A few years ago he organized the Electric Gold Mining Co. and did some work, but financial difficulties followed the venture. There is reported to be no water at Weepah. Water for drinking and cooking purposes is hauled in thirty miles from the nearest source, and is too costly for bathing.

Michigan Legislature Considering New Mine Safety Measure

A new mine safety bill has been introduced in the Michigan Legislature. It calls for at least two shafts for each mine, and two exits for each drift, sublevel, or crosscut. Under the terms of the measure, a charge of negligent homicide could be brought against the operator if a fatality occurs where proper safety measures have not been employed. In case of a fatal accident, a petition signed by ten residents of the locality would bring about an investigation by the Attorney General and the State Department of Labor and Industry. Fines could be imposed for failure to comply with regulations regarding exits and other safety provisions. Representative Holland, father of the bill, recently made an unsuccessful attempt to instigate a legislative investigation of the Barnes-Hecker mine disaster at Ishpeming, Mich.

Carson Accounting Ordered at Tacoma

On Feb. 23, 1927, the case of Carson vs. American Smelting & Refining Co. came before A. G. Ellis, master in chancery, and proceedings were begun. The hearing was in Tacoma, Wash. Judge Ellis made an order directing the American Smelting & Refining Co. to file a statement in debit and credit form showing profits made by the company from infringements on the Carson reverberatory furnace patents since Nov. 14, 1915. Further proceedings were continued until March 15, 1927. Trial of the Carson Investment Co. against United Verde and United Verde Extension has been fixed for June 1, 1927, at Prescott, Ariz.

High-Grading in California

Agitation for change in some of the provisions of the California high-grading act continues. The Anderson bill proposing to remove the $100 license provision is being opposed by Senator

T. Ingram and Assemblyman H. C. Clondman. Ingram, according to a local account, explained that when high-grading was in vogue the gold buyer took advantage of the situation by paying only a part of the value of the gold. The Empire Mines was said to have faced a shutdown several years ago because of high-grading, as the company's books showed a deficit of $90,000 and a check-up indicated a loss of $150,000 through pilfering. A shutdown would have thrown 500 miners out of work. The act is thus a protection to operating mines. Clarence Logan contended that the license fee was too high and that there was as a consequence considerable trouble and expense in marketing small lots of gold.

DOWNIEVILLE ACTIVITIES

Near Downieville, five placer properties are in operation, as water is now available as a result of heavy snows. The Comet lode mine, in Jim Crow Canyon near Downieville, is working ten men and the mill is being operated one shift per day. Standard mine, in Sailor Ravine, has resumed work. The tunnel of the Associated Mines, Inc., in the Scales-Port Wine district, has reached 2,500 ft., and the gravel channel is expected to be tapped in the near future. Vandalia mine, near Shingle Springs, El Dorado County, has been leased for two years.

King and Queen Mine Reopened

Henry D. Morse, formerly chief mining engineer with the Butte & Superior Mining Co., is in charge of the work of cleaning out and retimbering the upper tunnel of the King and Queen mines, 3 miles from Keystone, Mineral County, Mont. The property is now controlled by Amalgamated Metals Mines Co., and within a short time commercial ore shipments will be started. The ores are mainly lead-zinc and silver. The tunnel taps the veins 300 ft. from the surface.

Cripple Creek Notes

The New El Paso Mines Co., Inc., started work on March 1 on an extensive development program on the ninth level of the El Paso mine. The company is under the superintendency of A. B. Woodward, and sufficient finances have been provided for adequate extension of the properties.

United Gold Mines Co. is doing development work on the W. P. H. mine through the Jerry Johnson shaft and has opened up veins parallel to the old Seiver and Harrison veins, which have already made good tonnage. Other laterals are being driven toward the Johnson, which has a 900-ft. shaft.

The Big Banta, Rose Nicol, and Trail mines of the United Gold Mine Co. are being operated through the Rose Nicol. The Rose Nicol shaft turned out more than 1,000 carloads of ore in 1926, and the 1927 production will be above that figure.

Plutocrat's mine continues to uncover the sensational ores that characterized it when it was first revived several months ago. Messrs. Nicolai and Benson say that the ore is of high grade.

Bullion Mining Continues Development

The Bullion Mining Co., operating a group of claims at Central City, Colo., has been making rapid progress since it started work two months ago. Its headquarters are at Quincy, Ill., and it also maintains a Denver office. The present work consists in blocking out of ore. When the company has sufficient ore blocked out it intends to install new milling machinery in the present building to bring it up to 150-ton capacity.

Development Program Under Way at Aspen

The mining district at Aspen, Colo., will be the scene of renewed activity through a combination of Utah and Colorado interests completed last week. The Continental Divide Development Co., a $10,000,000 corporation, organized in Denver some time ago, is being combined with the company known as William Snyder & Sons, of Salt Lake City, which is associated with the Combined Metals Reduction Co. and the National Lead Co. Continental will operate as a subsidiary of William Snyder & Sons.

An extensive development program has been laid out at Aspen. This work was contemplated by the Continental Divide company some time ago, and it secured 500 acres of land from the D. R. C. Brown Mining Co., of Denver. It is upon this ground that operations will be started.

The ground taken over includes the Cowenhoven tunnel, two and a half miles in length; the McVeight property, consisting of 155 acres; the Dawn Lode, of 20 acres; the Enterprise group, totaling 115 acres; Forest Hill group in Taylor Park, consisting of 200 acres; the Park Tunnel & Mining Co. properties, totaling 200 acres and including the Tourleotte, Bushwhacker, and other claims; the Alpine, the Realization, the New Homestead, and the New Alta.

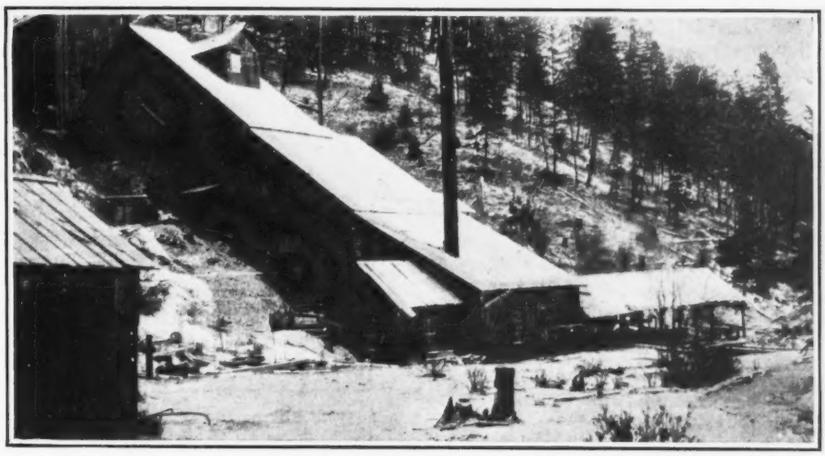
J. C. Jensen, of Salt Lake City, a director of the Continental Divide Co., will have charge of operations. Work will start as soon as the properties are officially turned over. The lease is to run for five years.

Bradley Acquires Sulphur Bank Quicksilver Deposit

The Sulphur Bank quicksilver deposit, on the eastern shore of Clear Lake about 10 miles north of Lower Lake, in Lake County, Calif., has been acquired by F. W. Bradley and his associates. A 100-ton rotary furnace is to be installed and the deposit is to be mined by power shovel.

Sulphur Bank mine is one of the old quicksilver properties of the state. It was first worked in 1865 for sulphur and the near-by Borax Lake for borax. In 1873 the property attracted attention for its quicksilver, and it became an important producer in 1883. Total production of quicksilver from the property is estimated at 100,000 flasks.

The Mercury Mining Syndicate, also controlled by the Bradley interests, has developed a quicksilver deposit 20 miles west of McDermitt, Nev., and 1½ miles north of the Nevada-Oregon line. A rotary furnace, crusher, and power plant were installed. The power plant consists of a 125-hp. Diesel engine operating a generator and a Sullivan angle-compound air compressor. The capacity of the furnace, which is now in operation, is about 70 tons per day, producing 350 flasks per month.



Concentrator at King and Queen Mine, Keystone, Mont.

Harbor Improvement at Crescent City, Calif.

Considerable importance attaches to the mining industry in southwestern Oregon and northwestern California by the recent appropriation by Congress of $750,000 to begin the permanent improvement of the harbor at Crescent City, Calif., for deep-water shipping. This will be the incentive for the immediate construction of the railway surveyed many years ago connecting the California and Oregon coast lines from Waters Creek to Crescent City, a distance of 70 miles over a mountainous country.

There are large quantities of shipping and milling ore in northern California and southern Oregon which carry gold and copper values, awaiting transportation and development; and in the region many copper-gold prospects have been partly developed, on the California-Oregon state line.

News From Washington

By PAUL WOOTON
Special Correspondent

Geophysical Prospecting Undertaken by Bureau of Mines—Potash Drilling Sites Announced —"Story of Copper" Filmed

DESPITE the failure of the second deficiency bill and with it the Oddie amendment providing, among other things, for geophysical prospecting, Director Turner of the U. S. Bureau of Mines has found a way to do a certain amount of work on devices for that purpose. Money primarily intended for other investigations, but which are regarded as being of less immediate importance, will be used for the prospecting study.

Mr. Turner, who has not abandoned all hope that the mining laws may be revised, points out that electrical prospecting should be credited as assessment work on mining claims. This would make it possible for the government to require that before such prospecting be accredited as assessment work the applicant should submit the results obtained by the geophysical method in the form of a map or a report from the company doing the scientific work. This could be filed as a confidential document, but it would give the government a chance gradually to build up a geophysical map of the area concerned. At present the results of prospecting usually are lost.

"Geophysical prospecting," Mr. Turner says, "when accredited as assessment work, should necessarily be backed by vouchers showing that certain sums had been paid to prospecting organizations. This would protect the government against fraud. Every one knows the ordinary form of earth and rock work, when sworn in as assessment work, is very often false work: Shooting cracks, claiming old talus slopes as part of assessment work, deepening natural depressions, and many other tricks of the trade have been noted by most engineers in the United States and in Canada. Geophysical prospecting is so new that advantage should be taken to start preserving the records at a time when practically all of the work could be preserved by some central impersonal agent such as the federal government."

Mr. Turner also believes that diamond drilling should be admitted as assessment work, with the provision that various owners of adjacent claims could be given the benefit of their contribution to a single drill hole, which could be put down on any one of the participating claims. He holds that everything should be done to encourage the preservation of the record of all drill holes. In that connection he deplores that so few cores are logged by competent geologists. Often the core is written up by the runner. Generally such reports are incorrect mineralogically, lithologically, and geologically.

The designation by the U. S. Geological Survey of two additional drilling sites in New Mexico for potash exploration was announced recently by the Bureau of Mines. This exploration is being undertaken by the government in an effort to develop an adequate domestic supply of potash salts.

In order of availability, these are the sixth and seventh sites designated by the Survey in the West Texas-New Mexico area and the second and third on public land in New Mexico.

The sixth location, in the northeast corner of S. 14, T. 20S., R. 29E, Eddy County, N. M., is approximately 19 miles northeast of Carlsbad and about 4 miles from the highway leading to the Artesia oil fields. The depth to the top of the salt beds is estimated at about 500 ft., and drilling will be continued to 1,000 or 1,500 ft., as conditions may determine.

The seventh site is located in the SW¼ S. 34, T. 22S., R. 30E, in Eddy County. It is approximately 23 miles east of Carlsbad and within a mile of a fairly good road, suitable for heavy hauling. The depth to the top of the salt beds and the depth for drilling are the same as at Site No. 6. These two sites are on public land, more than one mile from any privately owned land, and are thus not affected by the restrictive clauses of the enabling act, requiring that contracts be signed with all owners of land or mineral rights within a mile of any location before drilling can be started. Specifications for drilling at the sixth and seventh sites have been sent out to drilling contractors and bids invited. Proposals will be received up to 12 o'clock noon, March 23, and then publicly opened.

"Story of Copper"

Secretary Hoover and about four hundred other engineers and scientists in the government service attended the premier showing in Washington of the Bureau of Mines motion picture, the "Story of Copper." This eight-reel picture is in five parts, prospecting, mining, milling, smelting and refining.

Forest Service Recommends Mining Patents

Eighty-nine per cent of all mining claims within the national forests of the intermountain region, covered by applications for patent since 1906, in which final action has been taken, have been recommended for patent by the Forest Service. The other 11 per cent were protested and all but approximately 1 per cent were relinquished or cancelled by the Land Office as a result of the protest. Out of 2,216 claims covered by applications for patent, in only thirty of the cases was there failure to uphold the protest of the Forest Service, and twenty-two of these cases were prior to 1915 and all of them prior to 1921. In southern Idaho 89 per cent of all the claims were recommended for patent by the Forest Service. In Utah, 89.83 per cent; and in Nevada, 90.71 per cent.

Tenabo Changes to Flotation

While testing the water resources that can be developed at the Tenabo Consolidated Mines Co., Beowawe, Nev., preliminary to changing the mill over to selective flotation, the company plans to use the water pumped from its Gold Quartz shaft for placering operations. In addition to a quartz lode in which a considerable tonnage of $12 to $15 rock has been blocked out above the 137 level, the company has a large acreage of placer ground. Five thousand feet of pipe has been laid from the shaft to the site of placer operations.

Quicksilver Activities

The old Black Butte mercury mine, near Cottage Grove, Ore., is being started up, and a 100-ton plant has been ordered. A 4-ft. rotary furnace will be installed.

The Arizona Quicksilver Corporation is erecting a 100-ton plant, and production is expected to be started three or four months from date. This property is 90 miles northeast of Phoenix, Ariz. Austin, Wilson & Gamble are interested in a quicksilver property. A dozen small properties have changed hands recently in California.

Two new quicksilver mines in Washington have reached the producing stage. One is the Fisher Mercury Mining Co. and the other the Barner McDonel. Both are near Morton, Wash., which district produced over 500 flasks in 1926.

A recent local report contained the announcement that a 2½-ft. streak of good grade quicksilver ore had been struck upon the Yudnich prospect close to Pope Valley, Napa County, Calif.

Rumors are current that the Almaden mine, in Spain, is having trouble. It is stated that the workings between the twelfth and thirteenth levels have caved, curtailing production more or less.

Foley Mine on Production Basis July 1

Production at the Foley mine, at Mine Centre, Ontario, is expected to start by the first of July. Hydroelectric power from new developments in the district is expected to be available some time in April, and this will assist development, so that the present ore reserves may be materially increased before the mill is started. At present a raise is being run from the winze at the 400 level through to the surface, and when this is completed it will provide a shaft from surface down to the 850 level, the deepest working yet reached.

Granada Rouyn Constructs Camp

Installation of a plant and construction of camp buildings have been completed on the properties of the Granada Rouyn Mining Co., Ltd., four miles south of the town of Rouyn, Quebec. The Granada Rouyn is an amalgamation of about 10,000 acres of ground in Rouyn, Duprat, and Boischatel townships, and the present work is being done on the Rouyn holdings.

The plant now installed comprises a 250-cu.ft. compressor and a hoist capable of sinking to a depth of 750 ft. The plant will be driven by gasoline.

Announcement is made that the recently organized Laurier Mines, Ltd., has secured a small group of claims at the extreme western boundry of Duprat Township, immediately adjoining the eastern line of the Eplett-Metcalfe. This group has been much sought after, as it is in the immediate vicinity of the Consolidated Mining & Smelting Co.'s properties and just north of the Alderson-McKay holdings.

An electrical survey of the property of Aconda Mines, Ltd., Boischatel Township, northwestern Quebec, is to be started immediately by the Swedish-American Prospecting Corporation. The Aconda recently acquired an additional 2,000 acres, adjoining the northwest part of the township. The new ground is now being prepared, as it is planned to have the entire holdings covered with the electrical survey. G. R. McLaren is in charge.

Photograph Canadian National Railways.

Taschereau station on the Canadian National Railways—formerly O'Brien—from which point a branch line extends to Rouyn, Quebec, 44 miles distant

Photograph Canadian National Railways.

View of Parrault Street, Rouyn, Quebec, showing some of the new buildings. At the right, behind the birches, may be seen the modern hospital, with the Catholic school just beyond

Engineers Gold Cited

Engineers Gold Mines, Ltd., Atlin, B. C., which has had a particularly stormy career in the last two or three years, appeared in the financial news again when a temporary writ of mandamus was issued in the Superior Court in Wilmington, Del., ordering the books of the company to be produced on March 18. I. H. Isaacs and Frances Klausner applied to the court for the examination in order to ascertain the value of stock which they hold.

Cobalt Active

That the old Cobalt camp, in northern Ontario, is far from dead is seen in the fact that a number of new properties have started, and some old ones been revived during the last few months. The recent success of the Victory silver mine is attracting considerable attention. A promising discovery was made on this South Coleman property, and high-grade ore is now being mined.

Some of the newer activities include the O'Brien operations, in the Cross Lake section; the Lucky Tiger interests, working close to the Crown Reserve mine; the South Keora development, in Gillies Limit, and the work which Noranda interests recently launched on the Keweenaw property, which is an amalgamation of the Red Jacket, A-6, and four other claims.

Cheticamp Gypsum Quarry to Open

Active preparations are under way for operation of the extensive Cheticamp gypsum quarries in Cape Breton, Nova Scotia, by the Atlantic Gypsum Products Co., Boston. In readiness for the opening of summer navigation, 300 ft. of old trestle has been torn down, and work is to be started immediately on a modern conveyor system. A railway spur from the plant to the harbor is also being put into good condition.

Ore Receipts at Trail Smelter

Following is a statement of ore received at the Trail smelter for the period Feb. 22 to Feb. 28, inclusive:

Name of Mine	Class	Locality	Tons
Allenby Copper Co.	Copper concentrates..	Allenby, B. C....	357
Bluebell....	Milling.....	Riondel, B. C....	416
Enterprise..	Milling.....	Enterprise, B. C.	252
Homestake.	Milling.....	Louis Creek, B. C.	60
Lucky Jim..	Milling.....	Zincton, B. C....	305
Ruth Hope.	Milling.....	Sandon, B. C....	39
Whitewater	Milling.....	Retallack, B. C..	54
Wonderful..	Milling.....	Sandon, B. C....	50
Yankee Girl	Milling.....	Ymir, B. C.....	620
Bluebell....	Lead concentrates...	Riondel, B. C....	57
Lavina.....	Lead.....	Howser, B. C....	75
Sovereign..	Lead ore.....	Sandon, B. C....	47
Last Chance	Dry.....	Republic, Wash..	351
Quilp.....	Dry.....	Republic, Wash..	407
Company mines.....			13,714
Total tons.....			16,804

Photograph Canadian National Railways.

Shaft at the Noranda Mines property, Rouyn, the gold-copper area of northwestern Quebec. A townsite is being laid out on this land, and it is intended to make it a model community

California Rand Silver Resumes Dividend Payments

Resumption of dividends by the California Rand Silver Co., Bakersfield, Calif., is due to two factors—intelligent prospecting, which has developed 5,000 tons of ore, largely on the 12th level, in what was deemed a barren zone, and the discovery of a better method of treating the low-grade oxide or surface ores so as to effect a saving of 90 per cent of the values. Thirty men are now employed in mine and mill. The payroll is about $6,000 a month, and the monthly cost of operation is between $11,000 and $12,000. With this outlay, it is expected that at least four cars of concentrates with a net value of approximately $25,000 can be shipped to the smelter monthly. All income tax claims for past years have been adjusted and paid except one claim for $900 on the tax of 1923. The total income taxes paid the government during the life of the mine amount to $607,541.08.

Alaska Mining News

A shoot of high-grade ore, 9 ft. in width, has been developed in a raise between Nos. 3 and 4 levels of the Riverside mine, 7 miles north of Hyder. The mill was shut down for the winter, but will probably start up in May. Sufficient reserves have been developed to keep the mill in steady operation for four months. The upper tunnel is 110 ft. long, with a 6-ft. face of ore.

A shipment of 22 tons of concentrates has been made from the Helm Bay mine to the Tacoma smelter.

The Lake Virginia Mining Co. has been financed in New York to develop a group of mineral claims in Ground Hog Basin, near Wrangel. Plans call for 4,000 ft. of tunneling, 1,000 ft. of raises, and other development work. An air compressor, several thousand feet of steel rails, a caterpillar tractor, and other equipment have been ordered.

H. O. M. Buckholtz has bonded the Inspiration Point Mining Co.'s galena mine at White Pass, and is mining ore of an average value of $110 a ton.

The Hurlach Syndicate, of Philadelphia, is shipping 200 tons of freight to the Ammann property in Kotsina district on Copper River. The property includes 100 copper claims. Development is in charge of C. Simensted.

At Girdwood 94 oz. gold was obtained from a 500-lb. stamp operating for 22 shifts on gold quartz of the Monarch mines. A quartz deposit located on Crow Creek by H. Barnberger shows considerable free gold. J. and L. Reinken are opening up a promising quartz property on Mineral Creek west of Valdez.

A Minneapolis syndicate has taken an option on the Rhodes-Hall gold-quartz mine on Cleary Creek, Fairbanks, and proposes an extensive campaign of prospecting in the adjacent area. A rich oreshoot has been found in the Elmes Gold Mining Co.'s property at Fairbanks, the quartz containing coarse gold for a width of 2 to 7 ft. It is expected that sufficient ore will be available to maintain the ten-stamp mill in continuous operation. The Fairbanks Exploration Co. is employing six caterpillars in transportation of pipe to various points along Chatanike River where siphons are to be constructed to convey water from the big ditch. The work will require 3,000 tons of pipe.

The Flume Dredge Co. has moved its dredge from the Fothergill claim on Little Creek, Innoko, to No. 3 above, ready for operation in the spring.

A San Francisco syndicate has arranged to drill Peters Creek, in the Cache Creek district, to ascertain the prospects for dredging. The drilling plant is consigned to Talkeetna, on the Alaska Railway, and will be freighted from there over winter trails for a distance of 50 miles.

The New York Alaska Gold Dredging Co., of which L. B. Wallbridge is general manager, is planning to install a hydraulic plant on Bear Creek. The company operates a dredge on Tulaksak River in the lower Kuskokwim.

Alaska Juneau mined and trammed to mill 334,200 tons in February, 1927. Gross receipts were $204,500, or 61.19c. per ton; operating expenditures, $173,000, or 52.04c. per ton; operating profit was $30,600 or 9.15c. per ton; other expenditures and accrued charges were $19,000. The surplus for the month was $11,600.

Safety First Reward

THE sum of $2,880 in the form of $10 gold pieces was given to employees of the Homestake Mining Co., Lead, S. D., recently as awards for the men who have lost no time because of accidents. Accidents, experts say, are usually caused by carelessness, and so for the Homestake employees who are careful in avoiding them the company makes this reward each year.

Montana Mining Notes

Sam Howe and associates have taken a lease on a block of ground on the Salvador claim, near Walkerville, north of Butte, Mont., and owned by the Stettheimer brothers. Leasers will start work on the 350 level, and have given a contract to the Butte Machinery Co. for electrical equipment.

C. G. Fennell, mining engineer, is in charge of development work for the Continental Divide Consolidated Mines Co. The company is confining its operations to Bison Mountain and Nigger Hill, near Elliston, Mont. If developments warrant, the company will reconstruct and operate the mill formerly owned by the Monarch Mining & Power Co.

Maxville Continues Development

Shaft sinking continues from the main tunnel level at the property of the Maxville Gold, Silver Mining & Development Co., at Maxville, Mont. The shaft is at a point 1,900 ft. from the portal of the tunnel and 426 ft. from the top of the hill. It is 6½ ft. x 10½ ft. and now 80 ft. deep. At the 65 ft. point an orebody was encountered. Mill operations will be resumed about March 20 under the management of G. W. Quigley.

Kellogg Electrolytic Zinc Plant Well Under Way

The Sullivan Mining Co., which is building an electrolytic zinc plant at Kellogg, Idaho, in the Coeur d'Alene district, has awarded the contract for the construction of the main building to the Minneapolis Steel & Machinery Co., of Minneapolis, represented by W. A. Dodge, of Great Falls, Mont., Western agent of the company. The main building will be of steel construction, and it is expected that the material will be delivered and construction under way by March 15, as the concrete foundation is completed and everything is in readiness to proceed with construction. It will be 305 ft. long and 216 ft. wide, with a maximum height of 78 ft. The plant will be capable of turning out 50 tons of zinc per day.

Plans of the company also contemplate additions to the plant, as it is proposed to do a general custom business. The building of this plant has given quite an impetus to the development of so-called complex zinc-lead ores. Plans include a custom mill for the separation of the zinc and lead by flotation, from which the former will go to the electrolytic plant and the latter to the Bunker Hill smelter. It is expected that the zinc plant will be completed and in operation by Nov. 1. The electric power will be supplied by the Washington Water Power Co.

Power Estate Mines Sold

T. C. Power estate, of Helena, has sold its "Block P" group of mines to an Eastern syndicate, represented by F. H. Skeels, consulting mining engineer of Salt Lake City. The property is at Hughesville, 13 miles from Monarch, Cascade County, Mont., and has been operating for many years, the ore being mainly silver-lead-zinc, which was concentrated into high-grade products and shipped by truck to Monarch. The new owners are installing equipment to sink the main shaft to a depth of 400 ft., and are contracting for equipment for a 200-ton flotation plant.

Advance in Lead Price Helps Miners

The upward turn in the price of lead on March 2, when the price advanced from 7.40c. to 7.55c., with a further advance the next day to 7.65c., was a matter of much satisfaction in the Coeur d'Alene district, Idaho. Though the declining price of the metal during the last few months had not affected production, it is probable that a continuance of the low price, 7.40c., which prevailed throughout February, would have soon been followed by a curtailment of production by the chief operators. A more optimistic feeling now prevails, and producers are hopeful that the advance will continue to at least 8c., which is regarded necessary in view of high operating costs. On account of increased cost of production, 8c. corresponds to about 5c. in pre-war days.

Employees of the mining companies in the Coeur d'Alene district have been the chief sufferers as a result of the low lead price. Their wages are fixed by a sliding scale based upon the price

of lead, the average price for one month fixing the wages for all employees during the next month, the scale applying to employees in all departments—mines, mills, smelter, and office force. Under this scale, 25c. per day is added or subtracted for each advance or decline of half a cent in the price of lead, taking the average New York price for the month. The scale fixes the basic wage for miners at $3.75 per day and muckers $3.25 per day when the price of lead is 5c. and under 5.5c. Last month the average price of lead was 7.40c., which means that miners and muckers during March will receive a bonus of $1 above the respective basic wages, or $4.75 for miners and $4.25 for muckers. This is the lowest wage scale since the war, and is conceded to be too low, since there has been no corresponding cut in the cost of living.

Sheldon Enlarges Old Shaft

Production at the Sheldon mine, near Walker, Ariz., is to be stopped while the main shaft is being enlarged and opened. Work of enlarging from two to three compartments will start at the 850 level and proceed to the surface. When this has been done the enlarging will be carried from the 850 to the bottom at the 950 level, after which the shaft will be deepened to the 1,500 level. Levels will be established at intervals of 150 ft. It is estimated that the work will cost $50,000. The alternative of sinking a new shaft was considered because it would avoid shutting down the mine, but the cost would have been at least $300,000. A sagging copper market made the shutdown less burdensome, so the enlargement program was chosen.

The Sheldon recently started to ship its concentrate to the Magma smelter at Superior.

Comstock Pilot Mill Yields Good Results

The pilot mill at the Comstock Silver property north of Kingman, Ariz., is concentrating between 65 and 75 tons of complex ore daily. Recovery is said to be between 98 and 99 per cent. The zinc and lead concentrates are particularly clean. In addition to the milling ore the mine is producing about 15 cars of shipping ore per week, which is sent to the smelter at El Paso. Development during the last year has opened up large tonnages of ore averaging $35 per ton in lead, zinc, silver, and copper.

Butte Hill Copper Development

On the 500 level, north crosscut, of the Butte Hill Copper Mining Co., a 4-ft. vein has been encountered about 235 ft. from the shaft. Though this vein does not contain commercial ore, it is mineralized, well formed, and has good walls. The vein will not be drifted on at present, as the company is driving to tap the Jessie vein, supposed to be about 300 ft. north of the shaft. The company owns eleven patented claims north of Walkerville, Mont., and is financed by Maurice J. Eisenberg and associates, of New York. Work is under the supervision of Glenn Anderson, a Butte mining engineer.

Toronto Letter

By Our Special Correspondent for Northern Ontario

West Dome Lake Shows Operating Loss—Equipment Rushed to Red Lake District

The first annual meeting of the shareholders of the West Dome Lake Mines, Porcupine, in four years was held in Toronto on March 9. It is understood that the directors had prepared a complete statement of the affairs of the company, which are in far from a satisfactory position; but the time was so taken up with bickering over minor matters that there was no opportunity to present the complete report. One of the principal causes for uneasiness is an item in the balance sheet, "Special suspense account" $113,769, which has not been explained to the satisfaction of the directors, and it is understood that this is taken as indicating a possible over-issue of stock. The president stated that the former secretary explained this item as the "proceeds of the sale of shares of certain shareholders which had been entrusted to him." It was decided to adjourn the meeting for two months in order that the affairs of the company might be investigated by a committee of shareholders. The operating statement for the year showed production of gold to the amount of $220,670 and costs totaling $269,490.

In February the Dome Mines, of Porcupine, milled 43,000 tons and recovered bullion estimated at $314,910, an average of $7.33 a ton, compared with $6.85 in January.

The Pioneer Mining Corporation has sent men into the Clearwater Lake district, northeast of Red Lake. The company has a number of claims under option in this district, on which there is one exposure approximately 24 ft. square which gave assays of $10 per ton. As the snow was on the ground when the examination was made, and as the exposure ran under a swamp, it was difficult to form any estimate of the possibilities, but with the work now in hand they should soon be determined. The Pioneer company is also meeting with encouraging results in the development of its Gaspe zinc properties. None of the main veins have been encountered, but some smaller veins have been cut.

At the Castle-Trethewey property, in Gowganda, production continues at the rate of 85,000 oz. per month. During the last year about 10,000 ft. of underground work was done and a number of oreshoots were cut, but only a few of these were developed to the point which would permit of an estimate of ore reserves. It is expected that the estimate at the end of the year will not vary greatly from that of last June, when 2,540,000 oz. were shown.

Noranda Orders Canadian Machinery

A statement by the president of the Noranda shows that equipment orders for the Horne property in Rouyn have already been placed totaling $1,390,000; 85.2 per cent of the orders were placed in Canada and 14.8 per cent in the United States. Of the total amount of money involved 73 per cent went to Canadian firms.

In the lead-zinc area of Sudbury it is understood that several important deals are now being negotiated, and their successful completion will involve the entry of large American interests. The Bunker Hill & Sullivan people have contracted with the Wahnipitae Power Co. for electric power and a pole line is now being built to the property.

Howey Gold Freighting Supplies

The Howey Gold Mines, in Red Lake, have eight tractors taking in 250 tons of freight. Half of the freight has now reached Pine Ridge, 40 miles from the property, and the remainder will reach there within a few days. As soon as all the supplies and equipment are on the ground a 300-ft. shaft will be sunk and the property opened up at three different levels, in order to put tonnage in sight as quickly as possible.

West of Red Lake, in Manitoba, the San Antonio property is being developed. The sum of $200,000 has been raised for the preliminary development of the property, and it is understood that additional sums can be obtained if required. Seven separate veins are indicated, one of which has been traced for 1,900 ft. A working shaft is now being put down, and about 70 men are employed.

At the annual meeting of the Kirkland Lake Gold Mining Co. held in Toronto recently, the president stated that the directors had in mind a plan to retire 1,000,000 preferred shares of the company. A bylaw was passed increasing the directors from five to nine. The suit instituted by one of the shareholders to compel the directors to pay the dividend declared by the old board has been heard, but judgment has been reserved.

Imports of Precious Stones Show Increase

Imports of all types of precious stones into the United States during 1926 were valued at $80,651,281, representing an increase of more than $5,000,000 over the total of $75,270,956 purchased from abroad during 1925, according to information made public by the Department of Commerce.

The 1926 importation of precious stones included $13,070,767 worth of rough uncut diamonds, compared with imports of those stones totaling $9,492,328 in the preceding year. Receipts of diamonds cut but not set were valued at $51,361,942 during the year, against imports amounting to $49,620,666 in 1925. Of that type of diamond purchased from abroad, the Netherlands contributed a total of $27,079,149, compared with $25,264,131 in the year before; a total of $20,875,576 arrived from Belgium, against the total of $21,336,808 received from that country in 1925; the United Kingdom was the source of imports aggregating $1,778,386, compared with $1,173,456 in the preceding year, and the remainder, of a total value of $1,413,542, came from France.

London Letter

By W. A. Doman

Special Correspondent

Russo-Asiatic Lost to Soviet—Lena Goldfield Continues Operation

London, March 1—As was only to be expected, the British Government's note to the Soviet authorities created considerable interest and evoked much criticism, for apart from its political aspect it had a bearing upon British capital invested in Russia. The Russo-Asiatic Consolidated Concession seems to be gone for good. It is curious, however, that just at this juncture the representatives of two large Russian companies should issue reports, or statements, speaking in favor of the Moscow authorities. One is the Lena Goldfields, and the other the Russian Oil Products. For the latter to lay claim to being a benefit to this country by reason of a reduction in the price of oil is strange, seeing that the oil fields were developed by British capital and the companies have been dispossessed of their properties. Having no outlay on which interest must be earned, the Soviet can afford to undersell producers elsewhere.

The Lena Goldfields Concession is unquestionably one of the richest and most remarkable in the world. Apparently the directors are satisfied with the arrangements made with the Soviet, and substantial amounts of gold are being won from the alluvial deposits. In the circular, however, no mention is made of profits, though operations have been in progress for more than a year, and considerably over £1,000,000 worth of gold has been recovered. Expenses are said to be heavy. The ground yields from 60s. to 80s. per cubic yard of gravel. A large Bucyrus dredge has been purchased, equipped with seventeen buckets, to treat a dredging area in the district. The component parts have arrived at Irkutsk, and 2,000,000 cu.yd. of gravel per annum is to be treated. The Ural iron and copper mines and the Altai concession are also under consideration.

Rumor has been busy connecting a South African finance company with the Nigerian Base Metals Co. At first it was thought to be the Johannesburg Consolidated Investment, but I have heard it whispered that it is the Consolidated Mines Selection Co. This latter company has its representatives in the principal mining fields in Africa, as well as in Australia and South America.

The Ashanti Goldfields Corporation has issued its annual report for the twelve months ended Sept. 30 last. Since the change over from the wet-crushing process in November, 1924, to dry crushing and roasting, the extraction has improved to 91.4 per cent; and better results are hoped for. At the No. 21 level in the Ashanti mine the ore channel contains more graphite than usual, and has flattened somewhat on the dip.

The annual report of the British South Africa Co. was not received enthusiastically, seeing that the bulk of the profits were obtained from share dealings. Until the shareholders' meeting is held it is not possible to say whether the consideration received from the sale of base-metal concessions has been disposed of, but it is generally believed to be the fact, and in that case such profits cannot recur. Those who obtained the concessions and formed the companies are likely to benefit to the greatest extent.

Owing to the improvement of railway facilities, it is proposed to reopen the Kansanshi copper mine, in Northern Rhodesia. It was closed down in 1914, in consequence of difficulties in carrying on under war conditions.

Johannesburg Letter

By John Watson

Special Correspondent

Rand January Production—Platinum Production Costs Decline; Appreciable Quantity Marketed

Johannesburg, Feb. 8.—The following results of crushings, for the month of January, from fifteen leading Rand gold mines have recently been published. The mines are arranged in the order of profits earned:

	Tons Crushed	Value or Revenue £	Costs per Ton s.	Costs per Ton d.	Estimated Profit £
Government Areas	200,000	385,789	15	9.7	230,217
New Modder	131,000	298,187	18	5.1	177,526
Crown Mines	208,000	294,366	20	0.5	85,967
Modder Deep	44,200	99,721	15	4.0	65,806
Springs	70,200	131,431	19	2.5	64,014
Brakpan	87,000	139,206	18	0.1	60,864
New State Areas	72,000	131,650	21	8.7	54,061
Van Ryn Deep	63,500	104,910	17	7.6	50,194
Modder B	67,000	111,692	18	6.2	49,655
Geduld	82,000	115,483	16	6.0	47,732
Sub Nigel	17,500	.....	39	10.7	30,324
West Springs	48,500	75,179	18	6.6	30,201
Randfontein	193,000	206,397	18	6.3	30,183
City Deep	91,500	128,535	23	4.7	21,508
Robinson Deep	67,500	.....	19	8.7	20,339

The mineral output of Southern Rhodesia for December, 1926, as given recently by the Rhodesia Chamber of Mines, had a total value of £329,437. The value of the gold recovered was £202,836; that of silver, £800; of coal, £34,329; of chrome ore, £44,168; of asbestos, £44,969; of tantalum, £60; of mica, £1,743; and of diamonds, £541. Total mineral production for November had a value of £350,565.

The directors of Springs Mines, operating in the Far East Rand, have decided to proceed at once with the sinking of a new shaft to facilitate work in the southern section of their property, where it is hoped developments may warrant a further increase in the company's reduction plant. It is also possible, in view of recent developments, that the Sub Nigel plant will be still further increased. Modder East directors are seeking additional mining claims from the government.

Onverwacht Platinum, Ltd., recently issued its quarterly report, showing that 5,517 tons was milled, giving 8.36 dwt. per ton. Working costs were 41s. 6d. per ton and the net realization from 2,051 oz. of refined platinum was £39,102, or £19 1s. 4d. per ounce. As compared with the previous quarter, working costs were 11s. 7d. lower per ton of ore milled. Capital expenditure totaling £15,796 included the purchase price of the freehold rights of the remaining extent of the farm Onverwacht, £4,605. The company now owns the freehold and mineral rights of the entire farm.

Lydenburg Platinum Areas, Ltd., during the last quarter of 1926 shipped 1,305 oz. of metallics, of which 954 oz. was gold containing 706.327 oz. of refined platinum-group metals, the net realization from which gave £11,467, or £20 9s. 8d. per ounce.

On the Johannesburg Stock Exchange, during the last week, the share market has been active. Business, chiefly of a professional nature, was on a great scale, to which London orders contributed largely. Van Ryn Deeps were active early in the week, but closed on Saturday at 59s. 6d. Brakpans have been largely bought by London and their price has risen from 86s. 6d. to 91s. Geduld have improved from 86s. to 91s. 6d. T. C. Lands improved during the week from 52s. 6d. to 60s. 6d.

Large Dredge Constructed in Malaya

One of the first tin dredges to be completely constructed in Malaya has just started operation for Tanjong Tin, Ltd., at Tanjong Toh Allang. The new dredge is of the steam-driven bucket type, and was, with the exception of specialized parts, entirely designed and constructed in Singapore. It ranks as one of the largest dredges now operating in Malaya, the pontoon being 174 ft. long and 54 ft. wide, divided into thirty watertight compartments. It is designed to dredge to a depth of 70 ft. below water level, necessitating a bucket ladder 135 ft. long, weighing, together with buckets and spoil, about 300 tons. It is provided with buckets of the close-connected type, 113 in number and each of 9 cu.ft. capacity. The plant has a calculated digging capacity of over 240,000 cu.yd. per month of 600 working hours. The tables have a superficial area of nearly 8,000 sq.ft.

Jarbidge Producing $132,000 per Quarter

Bullion tax reports from the Jarbidge mining district, in northern Elko County, Nev., show that in the third quarter of 1926 the district produced $131,878.50, with net proceeds of $22,303.91. The Elkoro Mines company produced 5,705 tons of ore, which averaged $12.304 per ton, the gross value of which was $70,191.44, net profit being $13,072.77. The United Eastern Mining Co., which is operating the Bluster and Success groups on lease, produced 5.545.7 tons of ore, which averaged $11.10 per ton, the gross value being $61,687.10, and net profit $9,231.14. Values are practically all in gold, and cyanide plants are in use. It is reported that operating profits are not sufficient to enable the United Eastern to continue.

Societies, Addresses, and Reports

Mining Methods Discussed by Engineers

Is There a Trend Away From Shrinkage Stoping?—Notman, Van Valkenburgh and Others Contribute

"ONCE IN A WHILE it is necessary for mining engineers to say something about mining," remarked J. E. Spurr, chairman of the New York Section of the A.I.M.E., at the regular monthly meeting at the Machinery Club on March 15. With this in mind the program committee had selected the topic of "Mining Methods" for discussion at this meeting, he continued. The first speaker introduced by the chairman was Arthur Notman, whose topic was "Caving Methods at Miami." Mr. Notman began by remarking humorously that he had discovered that George J. Young, in his paper on "Supporting Underground Openings in Mines" (*Engineering and Mining Journal* of March 12), had said of the methods at Miami what he himself had intended to say at the meeting. Since this was the case, he said, he would confine his attention to specific cases. Certain problems had presented themselves to the Miami Copper Co. when they had exhausted their so-called high-grade orebody. How to mine their large low-grade body was the problem—a complicated one because the nature of the ground made them doubtful of their ability to cave it with success. The ground was somewhat harder than in the high-grade body. However, they had kept complete record of their former operations.

Under the old method they had extracted at a satisfactory profit about 7½ tons for each man employed in the mining department, this including all labor necessary to put the ore in the mill bin. Under the modified method finally adopted they raised their output to 29 tons per man, or four times the former figure. The amount of development work necessary had shown no very great reduction, but costs were lowered.

All were familiar with the block-caving system at Miami and Inspiration. The "keynote" in Miami's case had been in the increase in the lift taken from the caving level. This had formerly been about 75 ft., so that all development work had to be repeated every 75 ft. Now they were taking 240 ft. from the caving level to the capping. One secret was in the driving of a perimetral drift around each 150-ft. block about every 30 ft. in elevation. At each corner of each block a shrinkage stope was driven to weaken the corner so that the block would come down evenly.

The company had now completed the extraction of blocks containing 2,000,000 tons of ore, said Mr. Notman. This tonnage contained 99 per cent of the original copper content estimated at the outset, and, in volume, equaled 113 per cent of the originally estimated tonnage. There had been some dilution, the copper running about .93 per cent instead of a little over 1 per cent, as originally figured upon. Mr. Notman said that the present manager at Miami, Mr. Maclennan, had stated that he felt that with a column of ore 250 ft. vertically in a porphyry deposit, it would be possible to beat steam-shovel methods. Mr. Notman said that he was not at all sure that this had not been done. Where the ratio of capping to ore was a little higher, said Mr. Notman, there might be a drift to underground methods.

This marked a trend away from shrinkage stoping methods, said the speaker. Shrinkage stoping, no doubt, was very cheap and would probably hold its place, but its field was narrowing. There were certain disadvantages in the method, such as the inability to sort. When an orebody had an irregular outline, with the shoots irregularly distributed and possibly with parallel shoots, shrinkage stoping did not give the opportunity to find them or to mine them cleanly when found. One example of the trend was the method used in mining the multiple shoots at Porcupine, these occurring *en echelon*. These shoots were wide enough for shrinkage stoping, but were so numerous that that method, if followed, would weaken the ground. At Porcupine they were now resorting to cut-and-fill, which offers a better chance for sorting and prospecting.

W. Rowland Cox was asked for comment following the conclusion of Mr. Notman's speech. Mr. Cox said that he really hadn't thought about it. He had a body of very hard ore at present, he said, and had not yet reached a conclusion as to how he should proceed to mine it. No method pointed out seemed to apply. He reminded his audience that the old Silver Lake mine had been worked in the same fashion as the orebodies at Porcupine, and that they had been able to hold the ore in pay dirt, which could not always be done with the shrinkage system.

The discussion turning upon the procedure where the capping carried values, Mr. Notman said that at Sacramento Hill, where the capping was too low in grade for milling, the Phelps Dodge Corporation had stored it in heaps for leaching, so that any recovery that could be made from it was a source of added profit. But perhaps leaching in place was preferable, he added.

Another speaker was R. R. Van Valkenburgh, superintendent of the Mount Hope iron mine, near Wharton, N. J. Mr. Van Valkenburgh said that he had counted on having J. L. Fozard present. The latter had developed an interesting method at the Beatson mine of the Kennecott Copper Corporation, in Alaska. Stephen Birch, the speaker said, had stated in a paper that this new method, an adaptation of shrinkage, was being tried because the copper content had dwindled at lower levels. Mr. Van Valkenburgh had heard the story of the adaptation. Having passed through the higher values at the surface, those in charge were confronted with the need of developing a cheap underground method within a certain time limit. The development of a true shrinkage system called for more time than was available. Mr. Fozard's method was applied to a block, 280 ft. wide and 800 ft. long, of ore consisting of disseminated chalcopyrite in greywacke. The hanging wall was slate in a fault plane. The stopes were laid out across the body from foot to hanging and equipped with chutes and grizzlies as in straight shrinkage. Raises were driven at regular intervals to the level above, and a block was then completely undercut. Then 20 ft. above chambers were cut out for drilling long down holes reaching from one raise to another. Each raise was equipped with a hoist, ladders, and slide. The preparation necessary was reasonable and the raising was cheap. Dilution was fairly well controlled because of the relatively short length of hanging exposed on each stope.

At the Mount Hope mine, said the speaker, they had been using regular shrinkage for years, but during the past year had tried the Beatson system on a small block. They had finished preparation and were ready to break. Costs of preparation had proved to be under the estimate. Further, it was expected to reduce the hazard of work and also to increase the tonnage broken per machine shift, even if the preparation shifts were included in the total.

An important contribution of the evening, though indirectly related to the topic, was that of B. F. Tillson, of the New Jersey Zinc Co., on "An Improved Method of Underground Haulage." Mr. Tillson described in considerable detail how in the effort to eliminate hand tramming on other than main levels his company had developed two small storage-battery units of 3-ton and 1½-ton size respectively. There had been a need for small portable units to handle small mine cars—that is, units that could be shifted from level to level via a timber slide.

Mr. Tillson's paper was received with interest. We were not prone to put as much thought as was desirable, he said, on the matter of selecting haulage equipment. The problem was not simple, conditions were difficult, and careful study was required.

The concluding speaker was H. G. Moulton, who, discussing what had already been said on mining methods, referred briefly to the practice used by Granby, where some remarkable results had been obtained.

American Mining Congress Meets in Birmingham March 21-22

Arrangements are completed for the second industrial development conference to be held by the Southern Division of the American Mining Congress at Birmingham, Ala., March 21 and 22. Appearing on the program will be speakers representing various industries in different sections of the country, who will discuss pertinent problems in connection with industrial development in the South. Governors of Southern states have appointed delegates to the conference.

People You Should Know About

C. E. Meissner is now with the Chrome Steel Works, Carteret, N. J.

J. C. Dick, consulting engineer of Salt Lake City, spent two weeks of February in California.

J. E. Spurr is giving a course of lectures on "Magmatic Ore Deposits" at Columbia University.

Felix Edgar Wormser is back in New York after examining some copper properties in Oregon.

Ira B. Joralemon, mining engineer of San Francisco, is in Salt Lake City on professional business.

J. J. Beeson, Salt Lake City consulting engineer, visited Eureka, Nev., recently on professional business.

H. W. Hardinge, president of the Hardinge Company, is on a business trip through the West and South.

Frank M. Smith, of Spokane, Wash., was a recent guest at the meeting of the San Francisco Section of the A.I.M.E.

Philip Lawrence, of New York City, has been appointed a director of The Exploration Company, Ltd., of London, England.

George A. Shaw has severed his connection with the Talache Mines, Inc., at Talache, Idaho, and is at Quartzburg, in the same state.

E. H. Snyder, manager of the Combined Metals Reduction Co., has just spent two weeks at the Pioche, Nev. mines of the company.

Clinton J. Hansen, mining engineer of Butte, has returned to Butte after completing a professional engagement at South Porcupine, Ontario.

James E. Thomas, whose appointment as reduction officer to Doornhoek Platinum Mines, Ltd., was recently announced, has resigned that position.

C. P. McCormack, consulting mining engineer with Crowell & Murray, Cleveland, Ohio, is examining properties in the Kirkland Lake district of Ontario.

D. C. Rohlfing, of Salt Lake City, consulting engineer, is at Aspen, Colo., directing geological work for the Continental Divide Development Co.

Lloyd T. Emory has returned to Philadelphia from Arizona, where he made an examination of the Gladstone-McCabe property for a New York client.

G. W. Crane, of Salt Lake City, consulting geologist, spent part of February at Rico, Colo., where he is directing operations of the Rico unit of the National Lead Co.

Dr. S. F. Haughton, senior geologist in the Union (South Africa) Geological Survey, and who recently paid a fortnight's official visit to Pretoria, has returned to Capetown.

J. H. Harrington, of Miami, Ariz., has been awarded a contract by the United Verde Extension Mining Co. to sink an 800-ft. shaft on the property in the Bisbee district.

R. M. Murray, general manager of the Mount Lyell Mining Co., of Tasmania, has been elected president of the Australasian Institute of Mining and Metallurgy for 1927.

Ivan J. A. Diamond, a mining engineer with Union Minière du Haut-Katanga, left Elisabethville, in the Belgian Congo, on Feb. 28 for a six months' holiday in Europe.

A. J. Brett, consulting engineer of the Central Mining & Investment Corporation, Ltd., in London, with Mrs. Brett, recently arrived in Johannesburg on his bi-yearly visit to the Rand.

D. I. McLeod and Dr. J. Mackintosh Bell, of Toronto, directors of the Pioneer Mines, have left for the south of France to meet the English directors of the Pioneer and associated companies.

Sir W. Charles Wright, chairman of Baldwin's, Ltd., with Lady Wright, reached Johannesburg on Feb. 5. They were met by **W. H. Haig**, the firm's managing director for the Union and Rhodesia.

Charles Spearman, consulting mining engineer, of Montreal, has just returned to that city from an examination of the property of the Selkirk Gold Mines, Ltd., in the Rice Lake district of eastern Manitoba.

D. D. Muir, Jr., manager of the United States Smelting, Refining & Mining Co., is back at Salt Lake City headquarters after a month's absence, during which he visited Boston, New York, and Washington.

H. M. Wirtz, Bisbee (Ariz.) Chief of Police, and **W. D. King**, attorney specializing in Mexican law, with headquarters in Douglas, Ariz., have been appointed directors of the Mosqueteros Mining Co. **E. F. Knotts**, of El Paso, is president of the company.

W. H. Wainwright, of the Melbourne University, Australia, has been awarded the Sir A. T. Danks prize, 1926, for the best paper by students taking part in the visit of the Australasian Institute of Mining and Metallurgy to Newcastle, New South Wales, in 1926.

E. Wittenau, general mill superintendent; **R. C. Thompson**, general mine foreman; and **E. G. Lewis**, metallurgist, of the Copper Queen branch of the Phelps Dodge Corporation at Bisbee, Ariz., spent part of February in visiting Salt Lake valley metallurgical plants.

Leslie Bradford, one of the first metallurgists to take out a flotation process patents, visited Salt Lake City plants recently. Mr. Bradford, who is an official of the Broken Hills Proprietary company, is in America to study the steel industry, which his organization is planning to enter.

F. H. Viets, chief engineer of the Western Precipitation Co., Los Angeles, has left that city for Douglas, Ariz., where he will put the precipitation installation recently installed in the Copper Queen plant of the Phelps Dodge Corporation into full operation.

Fraser Alexander, who went to Kimberley, Cape Colony, South Africa, in the early "70's," and to the Rand in 1886, and who was for many years cyanide manager on the New Heriot and on Ferreira Deep, now resides at Benoni and is standing as South African Party candidate for the Provincial Council.

Dr. B. S. Butler, of the U. S. Geological Survey, on the evening of Feb. 17 lectured to the students of the Colorado School of Mines on the subject of "The Origin of Ore Deposits, With Particular Reference to the Ore Deposits of Utah." The lecture was presented under the auspices of the local chapter of Sigma Gamma Epsilon.

Dr. Robert Harvie, who has been conducting geological investigations in Clericy Township, northern Quebec, with a view to developing mines out of the favorable copper-gold showings of that district, announces that his company's efforts have met with success, and that underground development and diamond drilling are fully warranted.

Frederick Burbidge, of Wallace, Idaho, was elected president of the Idaho Mining Association at its twelfth annual meeting held at Boise on Feb. 11 and 12. **J. B. Eldridge** was chosen as vice-president, and **Ravenel Macbeth** was re-elected secretary-treasurer, and now enters upon the fifteenth year of service as secretary-treasurer of the association.

Professor E. K. Judd, of the Union Carbide & Carbon Corporation, and **Harold Fabian** attended meetings of the Rocky Mountain Coal Mining Institute to demonstrate the Judd methane detector. Professor Judd is the inventor of the device and Mr. Fabian is secretary of the Utah operators' committee under whose auspices research into safety measures for coal mines was begun.

Arthur R. Wilfley

An Appreciation

Arthur R. Wilfley, the inventor of the concentrating table which bears his name, was born in Maryville, Mo., April 29, 1860. Shortly after, his parents moved to Kansas City, Mo., where he received his early education. At seventeen he was working in a grist mill and, somewhat later, helping his father run a sawmill. Destruction of this mill by fire turned the eyes of father and son to Colorado, then experiencing the boom at Leadville. At eighteen young Wilfley found himself on a flat car, accompanying a sawmill boiler from Kansas City to Canon City, Colo. From here the boiler was freighted to Kokomo, in the winter of 1878, just before the rich lead-silver deposits were found there.

Wilfley soon turned to mining and for some years worked as a miner and prospector. Securing a lease he made enough money to buy the mine. At Kokomo he met Victor G. Hills, mining engineer, who loaned him books. He studied assaying and surveying alone at nights, and later hung up a shingle as assayer and surveyor, to which he added the title of Deputy Mineral Surveyor, after passing an examination in Denver.

The principal claims acquired by Mr. Wilfley were the Aftermath and White Quail. Consolidated under the name of the Summit Mining & Milling Co.,

these furnished much lead-silver ore to lead smelters and iron ore with a little copper to a matting furnace, operated by Wilfley in partnership with Thomas Walsh, at Kokomo.

The lead-silver ore was found to be irregularly deposited in masses of low-grade iron sulphide and lead-zinc-iron sulphide, and Wilfley turned his attention to devising a method to concentrate these sulphides and to separate the lead from the zinc. The zinc in lead ores was penalized at lead smelters and there was no market for zinc ores. His attempt to devise a method of separating the minerals and concentrating the salable minerals was perhaps at first directed more toward concentrating the heavy iron than in separating the zinc, but the table, though not making a complete separation of all minerals, did concentrate the heavy minerals and also separated some of them from one another. At that time, the concentrating and separating machines in use were the Gilpin County bumper and the Frue vanner.

Wilfley was a man of deep concentration, and when he set his mind to working out this problem he doubtless, as was his habit throughout life, excluded all other affairs. It seems reasonable, according to information given by his sons, that he was working on this problem as early as 1890. The surface of the table soon appeared to be the key to the problem. He tried all sorts of hardwoods and even plate glass, but finally fell upon the idea of trying linoleum, then coming into use as a floor covering. The original table was made at Kokomo, and in May, 1896, was used at Mr. Wilfley's mill there. The first table sold was installed in August, 1896, in the Puzzle mill, at Breckenridge. Mr. Wilfley's first patent was received in April, 1897.

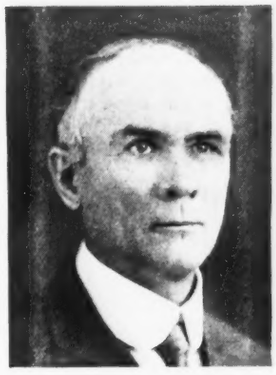
The introduction of these tables throughout the world was rapid. The Mine & Smelter Supply Co. early took over the manufacture and sale and Mr. Wilfley became a director of and consulting engineer to the company. One of the company's heavy expenses in the early days, it is interesting to note, was the cost of litigation over the patent.

The table as first built was developed to such a point of perfection that practically no change has ever been made in its design. Much has been written of the size and capacity of the table, but Mr. Wilfley is authority for the statement that the size was the biggest that would go into a narrow-gage railroad box car.

In 1905 Mr. Wilfley retired for several years from engineering practice and began the collection of rugs and porcelain, on which subject he became an expert. In 1910 he again entered the mining and milling game, at Nogales, Ariz., in a project which he called his "big venture." This was the Pride of the West Mining & Milling Co. The plan for treating the ore at this property, a lead-zinc-copper-iron sulphide, included roasting, magnetic separation, wet concentration, and reverberatory copper smelting. Previous to 1912 he had designed a roasting furnace.

This Arizona venture cost Wilfley a considerable slice of his personal fortune, and in 1912 we find him operating a slime concentrating plant, near Silverton, on tailings out of Silver Lake as deposited there by the Stoiber mills. Previous to 1912 he had developed a slime table, including the double-decker slimer, and these were used in this slime plant. While at work here he noticed the progress flotation was making, and discontinued the use of his slimers and put in flotation in his own mill.

As early as 1900 he had the idea of making a pump for sand and slimes. In his work at the slime plant at Silver Lake he had an opportunity to work on this pump. Experimental work was continued in 1920 and 1921, and selling of the pump was begun in 1922, without previous advertising. The pump was finished when put on the market. This pump is now in use in practically every country in metallurgical operations and also in cement and chemical fields. Its chief point of value is in the elimination of the customary stuffing box.



Arthur R. Wilfley

In 1921, when on a trip to Tonopah, Nev., Mr. Wilfley became ill and was taken to a hospital in San Francisco, where he lay for many months. This illness was the beginning of the end, but he kept himself alive until Feb. 20, 1927, when he died at Whittier, Calif. Despite his illness, in 1922 he began developing something else, and started work on a porcelain acid pump, which just before his death he felt had reached completion.

Mr. Wilfley was married in 1886 at Kokomo to Addie Farnham, and there were three children, May, George, and Elmer. George graduated from the Colorado School of Mines in 1913, and Elmer, in 1914. From then on the sons were associated with their father under the firm name of A. R. Wilfley & Sons.

CHARLES W. HENDERSON.

Obituary

August Paulsen, a well known and wealthy mining man of the Coeur d'Alene district of northern Idaho, died on March 11 at San Diego, Calif. Mr. Paulsen was interested in the Hercules Mine at Wallace, Idaho.

Arthur E. Fenot, mining engineer, and secretary of the Livingston Mines Corporation, died recently in New York City. He had been associated with the company from the time of its formation. Mr. Fenot was a graduate of Columbia School of Mines, class of 1903.

Thomas Searle died recently at Qui Qui, Kenya Colony, aged 46. He went to Johannesburg about twenty years ago and was for some time employed in the survey department of the General Mining & Finance Corporation, Ltd., which is one of the Albu group of mining properties.

Mrs. Emma Le Bel, one of the very few women mining engineers, if not the only woman member of the profession abroad, died recently at the age of nearly ninety, at Lampertsloch, in Southern Alsace. In former years she went daily into the pits and in a special laboratory worked constantly on technical and scientific research. The Le Bel family came in the eighteenth century from the south of France to Alsace, and was the first to exploit asphalt deposits in that region.

Carl Schott Fogh died at Salt Lake City on March 10. He was born in Denmark sixty-six years ago. After graduation in engineering at Dresden, Germany, he came to the United States and settled in Denver. Subsequently he served in engineering capacities for many industrial and mining companies. Since 1924 Mr. Fogh had been in charge of Wedge furnace design and engineering for the Bethlehem Foundry & Machine Co. At the time of death he was returning from a general business trip through the West and Southwest. Mr. Fogh was deeply interested in art, music, and history and was a close student of the Bible. He leaves a wide circle of friends and acquaintances, particularly in the metallurgical field. He is survived by his wife, one brother, who resides in Denmark, two sons and two daughters.

Alexander Campbell, a pioneer who was for many years closely associated with mining affairs in Australia, died recently. Going to that country as a Scotch cadet in 1872, he went into the "back blocks," and found his way to the town of Cobar, then a busy mining centre of New South Wales. Afterward he was attracted to Broken Hill, in the same colony, and in connection with some of the prominent mines of that field, as well as with other mining concerns, became associated with the late William Jamieson and W. R. Wilson, who were prominently identified with the mining industry in different states of the Australian Commonwealth. Mr. Campbell took an intense interest in mining, and was always an active figure in Broken Hill affairs. In late years, when the Broken Hill North began to achieve distinction, he, having previously been connected with the mine for many years, had a good deal to do with acquiring for it the Victoria Cross Block, into which the great shoot of ore mined by the company is pitching. He was also associated with the famous Block 10 and Block 14 Broken Hill companies. Mr. Campbell likewise was chairman of the South Australian Oil Wells Co., which is boring for oil on the border of the adjoining state of Victoria.

Recent Technical Publications

Reviews, Abstracts, and References

The 1927 Skinner

The Mining Manual and Mining Year Book for 1927. By Walter E. Skinner. Published by Walter E. Skinner, 15, Dowgate Hill, London, E. C. 4. Price, 21s. 6d.

This familiar directory of British mining enterprises arrives in March, as usual, and is of a similar character to the volumes that have gone before. Financial data are given concerning about 1,500 mining companies that are of interest to the British investor. This is preceded by tables giving annual yields and gold outputs of the British gold mines and a dictionary of mining terms. Also included in the 900-page volume are lists of directors, mining and consulting engineers, mine managers, and agents. The book would be more useful to Americans if more American companies were included. Some of the most important are omitted altogether, such as American Metal, St. Joseph Lead, and Cerro de Pasco, all listed on the New York Stock Exchange. But for companies within the Empire, the ground is covered pretty well, though it may be noted that a few operating Canadian mining companies have been overlooked; for example, Barry-Hollinger, Consolidated West Dome Lake, and the Asbestos Corporation.

Clerical Salaries in the United States. National Industrial Conference Board, New York. Price, $1.50.

Although wage statistics for the United States have been available in fairly comprehensive form for about a decade, comparatively little statistical attention has heretofore been given to the salaries paid office workers. Wages of factory and other industrial workers had presented the more urgent problem; moreover, data on office workers' salaries were found extremely difficult to ascertain. This study covers the range of salaries paid to both men and women employees in each of twenty specific types of office work. The data were gathered in eighteen large cities in different sections of the country.

The report supplies valuable information to aid business management in the formulation of salary policies. It also should prove valuable in determining the general economic status of the "white collar" worker.

High Vacua. By G. W. C. Kaye. Longmans, Green & Co., Ltd., London. Longmans, Green & Co., New York; price $3.75.

This subject is not of great interest to mining engineers, though some may find the text helpful in research work. Pumps for air exhaustion are first described, followed by chapters on electric discharges in vacuum tubes, high-vacuum technique, metal to glass joints, backing pumps, high-speed pumps, absorption methods of exhaustion, high-vacuum gages, and measurement of pump speeds. The subject matter is authoritatively and attractively presented.

Year Book and Directory of The South African Mining and Engineering Journal. Argus South African Newspapers, Ltd., 72-78 Fleet St., London, E. C. 4. Price 12s. 6d.

This year's South African year book has about 100 pages more than last year's, indicating the increasing importance of the mining industries of that continent. As usual, the volume contains directories of persons connected with the mining and industrial life; reports of the gold, diamond, copper, platinum, and other phases of mineral development; and reports of the financial and technical operations of the various mining companies. The job has been well done, and forms a valuable reference work.

Quin's Metal Handbook and Statistics, 1927. The Metal Information Bureau, Ltd., 79 Mark Lane, London, E. C. 3. Price 5s.

This convenient reference book is now ready, with statistics for 1926. The usual data on prices, production, imports and exports, grades, and uses for all the more important metals is included, with numerous advertisers who are buyers and sellers of ores and metals in the European market.

Metal Statistics—The latest edition of the annual Metallgesellschaft statistical compilation is in improved form, with explanations of the data in English, French, and Spanish, as well as German. The statistics cover aluminum, lead, copper, nickel, quicksilver, silver, zinc, and tin, giving mine and smelter production, consumption, and imports and exports for the principal countries of the world, for the years 1913, and 1919 to 1925 inclusive. The last section of this 83-page book gives prices that obtained in the principal markets. The compilation is published by the Metallgesellschaft, Frankfurt am Main, Germany.

Patents

Magnesite Refractory—No. 1,616,055. Feb. 1, 1927. August Marks, Carteret, N. J., assignor to U. S. Metals Refining Co. Magnesite brick or molded refractories are made by mixing a pulverized magnesitic body with linseed oil, molding, curing the molded article, and burning. Patent No. 1,616,192, issued to the same applicant and similarly assigned, covers an unburned brick made of a magnesitic body and a suitable drying oil, molded and dried to hardness.

Disk Crusher—No. 1,616.240. Feb. 1, 1927. E. B. Symons, Hollywood, Calif., assignor to Symons Brothers Co., Milwaukee. Design for a vertical disk crusher.

Copper Leaching—No. 1,618,187. Feb. 22, 1927. W. E. Greenawalt, Denver. Copper ore is leached with dilute acid and the resulting solution containing salts of iron and copper electrolyzed to precipitate the copper and to regenerate the acid and ferric iron. The electrolytic circuit comprises a reducer, storage tank, and an electrolyzer. A flow sheet of the circuit is given.

Volatilization—No. 1,618,204. Feb. 22, 1927. Friedrich Johannsen, Clausthal-on-the-Harz, Germany, assignor to Fried. Krupp Grusonwerk Aktiengesellschaft, Magdeburg-Buckau, Germany. A continuous process of charging ores containing volatile metals, and a carbonaceous reducing agent, into a heated metallurgical furnace in which an oxidizing atmosphere is maintained. The charge is made to advance through the furnace by rolling around, the metal being reduced and volatilized without slagging or fusion.

Sintering—No. 1,618,205. Feb. 22, 1927. John Knox, Chatham, N. J., assignor to Dwight & Lloyd Sintering Co., New York City. In a sintering machine, a method of propelling the receptacles for ore along upper and lower tracks.

Electric Smelting Zinc—No. 1,618,316. Feb. 22, 1927. Filip Tharaldsen, Christiania, Norway. In the art of electrically smelting zinc ores, a resistor consisting of a bath of acid slag containing from 15 to 25 per cent of iron, and 45 to 60 per cent of silica.

Gold Washer—No. 1,619,558. March 1, 1927. T. F. X. Beaudet, Blaine, Wash. A tank equipped to wash gold-bearing gravel and sand.

Flotation—No. 1,619,790. March 1, 1927. G. A. Bragg, East Orange, N. J., assignor to Metals Recovery Co., New York City. Ore pulp containing a large proportion of minus-200-mesh slime is subjected to a violent agitation with lime for a sufficient length of time to condition the sulphide minerals for subsequent flotation. The pulp is then subjected to a pneumatic flotation operation in the presence of a non-oleaginous mineral-collecting agent.

Classification—No. 1,619,807. March 8, 1927. A. L. Blomfield, Colorado Springs, and E. R. Ramsey, Denver, assignors to The Dorr Co., New York City. In a drag classifier of the Dorr type, adjustable means for adding liquid to the pulp to be treated, depending upon the accumulation of settled solids in the classifier.

Dry Concentrator—Nos. 1,620,242-3. March 8, 1927. A. H. Stebbins, Los Angeles. Design and equipment for a dry concentrator table.

Grinding Machine — No. 1,620,276. March 8, 1927. G. W. Morthland, Lead, S. D. A cylindrical grinding mill for ore, in which crushing shoes attached to a master ring are disposed in radial openings.

Vibratory Screen — No. 1,620,575. March 8, 1927. W. F. Schadel, Charleston, W. Va., assignor to Kanawha Manufacturing Co., Charleston, W. Va. A vibratory screen agitated by a revolving cam.

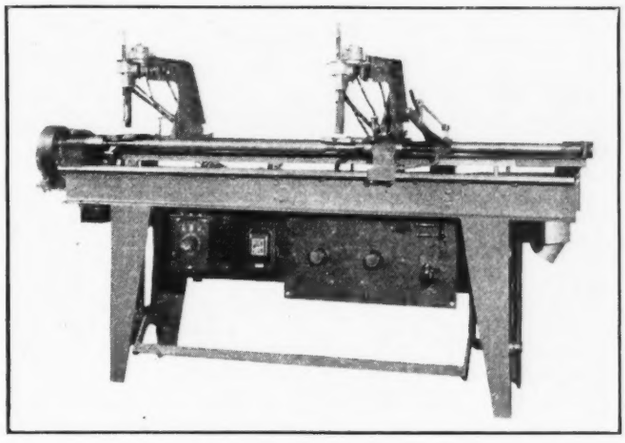
Hydrometallurgy of Tin—No. 1,620,580. March 8, 1927. E. A. Cappelen Smith, New York, assignor to Guggenheim Bros., New York City. Tin-containing materials are leached with mixed solvents containing tin and iron compounds and acids, and the solution electrolyzed to deposit a portion of the tin and to regenerate the solvent.

New Machinery and Inventions

New Butt Welder Operates with Carbon Arc Process

In a new butt welding machine introduced by the Lincoln Electric Co. is to be found a further application of the machine-driven carbon arc to the problems of welding. One ordinarily thinks of butt welding in terms of the resistance welder. The arc butt welder, according to the maker, is not an alternative method of doing butt welding, but, it is claimed, is a solution for a certain class of butt-welding problems which the resistance welder cannot solve. For instance, a plug may be welded into the end of a tube very easily with the arc butt welder, although the job would be impossible with a resistance butt welder. The machine illustrated welds both ends of the tube at once by use of the two automatic heads. A similar instance of applicability of the arc butt welder is that of welding a small diameter round bar to a large diameter bar. With the arc butt welder, the welding heat is applied to the joint by the carbon arc and the bars revolved to distribute the heat uniformly. Pressure is applied to squeeze out the slag and complete fusion.

Use of the arc butt welder, it is said, does not involve the difficulties with power supply encountered with resistance butt welding. The motor generator set used to supply current for the arc supplies direct current at 40 to 60 volts. The motor is a standard induction motor and does not take a special power rate.



This machine-driven, carbon-arc butt-welder marks a new application in welding

Refractory Cement Uses Chromite

General Refractories Co., Philadelphia, Pa., recently placed on the market a new high temperature cement. The basic component of this cement is chromite. It contains no sodium silicate or other quick-setting elements. The natural atmospheric quick-set has been intentionally retarded sufficiently to permit easy troweling without frequent addition of water. The cement is said, however, to have a reasonably quick and strong cold set, to set hard and uniformly and to maintain a constant bond through all temperatures. The fusion point is over 3,500 deg. F. and the tensile strength over 300 lb.

The cement is of neutral character and, in metallurgical work, has a resistance to acid as well as basic slags. It is claimed to give good service in boiler settings and similar furnaces where coal and ash slags form. In ceramic kilns and similar equipment it is said to give efficient protection to the brickwork from erosion by gases.

An Engine-driven Welding Outfit That Is Small and Compact

Another addition to its line of welding equipment, a small engine-driven welding outfit, has been announced by the General Electric Co. This set incorporates the G.E. WD-11 welding generator with a continuous rating of 150 amp. and a one-hour rating of 200 amp., the welding duty range running from 50 to 250 amp. The generator is driven by a Continental P-20 power unit rated 18.22 hp. S.A.E. and capable of developing 23.5 hp. at 1,400 r.p.m. It is equipped with a control panel, rheostat, and self-adjusting stabilizing reactor. Engine accessories include a strongly constructed radiator, pressure-feed lubricating system with oil-pressure gage and indicator, vertical-tube gravity-feed carburetor, air cleaner, centrifugal governor, starting crank, 10-gal. gasolene tank, tool box, and sheet-metal hood with sheet-metal side panels which can be locked in place.

Novel Telephone System Uses Power Transmission Lines

One of the recent developments of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., is duplex automatic telephony. This telephone equipment is designed so that communication may be established on a power system using the existing transmission lines as a channel of communication. The transmission line conductors serve as the connecting medium demanded in any system of telephony and take the place of the separate wires used in ordinary installations.

This means of communication, the methods employed in its operation, difficulties during development and the need for such a system are described in a booklet "Duplex Automatic High Frequency Telephony" published by the Westinghouse Electric & Mfg. Co.

A 30-Ton Gasoline Locomotive of Solid-type Construction

Recently a 30-ton gasoline locomotive was turned out by the George D. Whitcomb Co. This is one of the largest engines of its type that has ever been built, with the possible exception of one for experimental purposes. It is powered with a six cylinder 6½ x 7-in. Beaver engine, capable of developing 160 hp. at 1,000 r.p.m. It has a drawbar pull of 17,500 lb. on low gear without sand. (See cut below.)

The frame is of solid-type construction. the axles are of forged steel, and the wheels have chilled tread, or any type required. The transmission allows for all speeds, either forward or reverse, and sand is furnished at all four wheels.

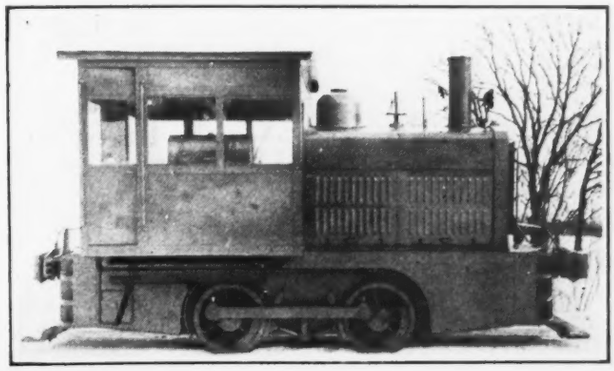
Catalogs

Speed Indicators—O. Zernickow Co., 15 Park Row, New York. Hand tachometers. Eight pages.

Tractors—Monarch Tractors Corporation, Springfield, Ill. Four-page bulletin on the 6-ton Model H tractor.

Welding—The Lincoln Electric Co., of Cleveland, Ohio, has just issued the 1927 edition of the "Instruction Manual." Among the subjects treated are: high-speed steel welding, high-pressure pipe welding, automobile frames, boiler repairs, welding cast iron, manganese steel welding, carbon arc welding, manufacture of machinery and equipment using welded steel in place of casting. Price $1.

A six-cylinder 160 hp. gasoline locomotive that is one of the largest of its type



Market and Financial News

Statistical Notes

Alaska Juneau Gold Mining Co. reports February gross receipts of $204,500 and profit after interest and development charges of $11,600.

Arizona Commercial Mining Co., operating in the Globe district in Arizona, during the year 1926 realized $149,087 after depreciation but before depletion. Current assets on Jan. 1, 1927, totaled $749,198, against liabilities of $87,644. The total production for the year was 5,985,607 lb. of copper, 34,614 oz. silver, and 1,444 oz. gold.

British Platinum and Gold company during 1926 dredged 423,850 cu.yd. of gravel in its placer fields in Colombia, for a net loss of £12,712. The recovery was 3,347 oz. platinum and 966 oz. gold. Unforeseen difficulties in operating are assigned as the reason for the poor showing.

Asbestos Corporation, Ltd., the amalgamated company that resulted from the merging of various large interests in the asbestos industry of Quebec, Canada, reports the following financial results as covering the first eleven months of its existence:

Profits for eleven months ended Dec. 31, 1926, after providing for taxes	$1,237,008
Interest on investments and bank deposits	86,649
	$1,323,657
Deduct bond interest	426,983
	$896,673
Deduct provision for depreciation	300,000
	$596,673
Deduct dividends on preferred stock	391,445
Surplus from operations	$205,228

Tintic Standard Mining Co., operating in the Tintic district, in Utah, reports a gross yield of $6,153,359 for the year 1926. The net profit was $2,688,359, which is equivalent to about $2.50 per share.

Silver King Coalition Mines Co., operating in the Park City district, in Utah, reports a net income for the year 1926 amounting to $1,312,625. Production, including first class ore and concentrates, totaled 49,831 tons, the metal content being as follows:

Lead, lb.	33,911,773
Copper, lb.	999,671
Zinc, lb.	8,421,164
Silver, oz.	1,792,300
Gold, oz.	2,772

Gross income, including miscellaneous, amounted to $3,188,444; operating expense, including depreciation, was $1,899,185. Decreased tonnage and lower market prices for metals are assigned as the reasons for the decrease in earnings during the year, compared with 1925.

Hollinger Gold Mines, Ltd., has advanced $1,300,000 already to Horne Copper Corporation, which controls Noranda mine, in the Rouyn area in Quebec, and is expected to increase the amount to $3,000,000 by the end of the year. Security is 7 per cent bonds that would be amortized in ten years.

Diamond output of South African mines in 1926 was £10,683,597, an increase of £2,485,469 against 1925. Alluvial diamond production totaled £3,983,681, an increase of more than £2,000,000.

Hecla Mining Co., for the year ended Dec. 31, 1926, reports gross income of $4,545,631, comparing with $4,551,649 in 1925. Net income after expenses, ordinary taxes, depreciation, depletion, and other charges, but before federal taxes, was $2,530,475, against $2,764,970. Lower prices for silver and lead caused reduction in earnings. The tonnage of ore treated was 348,472. Reserves are estimated at 2,640,000 tons. Costs per ton were: Mining, $4.274; milling, $0.904.

E. & M. J. Introduces New Set of Statistical Graphs

ON THE OPPOSITE PAGE the *Engineering and Mining Journal* presents for the first time a new page of industrial statistics that are of significance to those engaged in the mining industries. The monthly barometer of productive activity in non-ferrous metal mines is entirely new. It is based upon the quantity of electrical energy used in seventy large non-ferrous metal enterprises. These include mines, mills, and smelters situated in a dozen different states and representing copper, lead, zinc, gold, and silver producers. The total consumption of energy as reported directly to *Engineering and Mining Journal* by the companies, after segregation according to the principal metals produced, is adjusted for the number of working days in the month and is then reduced to an index number based on the average energy consumption during the months of October, November, and December, 1926. The indexes thus obtained are weighted in accordance with their approximate importance in the non-ferrous metal-mining industry, and thereby a composite figure for productive activity in the industry as a whole is obtained.

The year 1927 opens with the non-ferrous metal industries operating at a comparatively high rate of activity, continuing the upward trend which reports indicate has been under way since October, and possibly previous to that time. Owing to the smaller number of days in the month of February, however, the actual production in these mines was about 7 per cent under that reported for January.

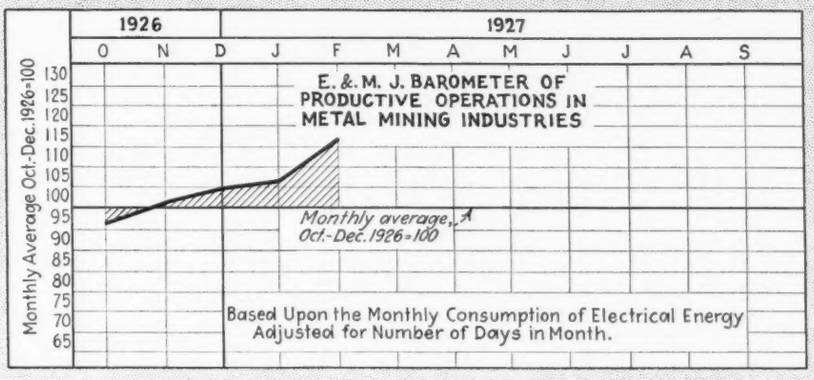
These statistical charts will be issued each month, and reprints will be sent to those interested in making them a part of their statistical files.

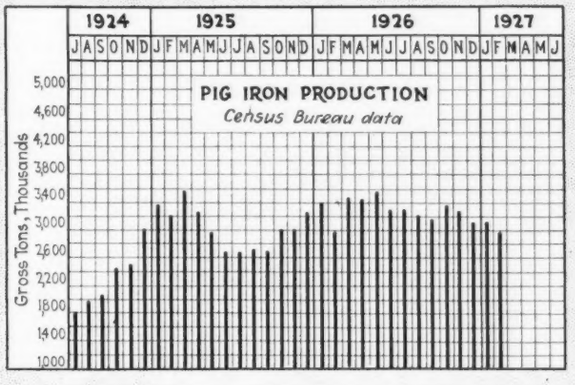
London Broker Criticizes Increasing Copper Price Too Rapidly

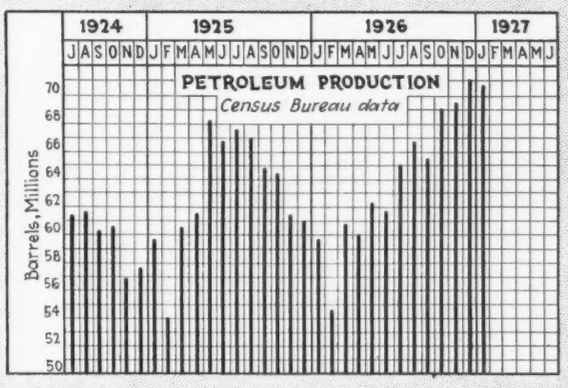
"Events have shown again that rehabilitation of a market which is suffering from overproduction can only take place when prices remain at a low level for some time, and not if prices are immediately raised as soon as buyers appear to take an interest in the article," according to the weekly Market Report of Brandeis, Goldschmidt & Co., London. "When copper touched 13c. and Copper Exporters, Inc., had reduced their price to that level, there was no doubt an inclination on the part of both consumers and merchants to lay in stocks, and as regards the former to increase their output of manufactured copper goods. If prices had only been allowed to remain there for a few months, or even only weeks, instead of a few days, the whole position of the metal might have materially changed, and have righted itself. We think that current production would have been easily absorbed and the existing surplus slowly used. But the quick raising of the price as soon as consumers were anxious to buy, and the curtailment of the quantities they were allowed to take, had a bad effect on business. Inquiries immediately fell off, especially as the copper exporters' price was raised further to £61 16s 3d. c.i.f. United Kingdom, and 13.37½ c.i.f. Continent. We are afraid that on the Continent very little copper will be bought at the higher level, and that in consequence American producers will again have to reduce their price later on and probably to below the level to which it had already fallen. This, to our minds, might have been avoided if only consumers had had an opportunity of trading freely. There was a very good opportunity of showing that stabilization was actually being effected, which, however, at the present moment seems to be further off than ever. We still contend that copper in itself is the cheapest of the non-ferrous metals and that if left to itself, although it might have to remain at a low price for some time, consumption would ultimately—at a not very far distant time—overtake production again and the price would rise naturally. The United States statistical figures for January are not very good, in spite of big exports. The production for January is, we believe, the largest ever seen in any one month, and it is quite natural that to absorb such a very big output prices have to be kept low."

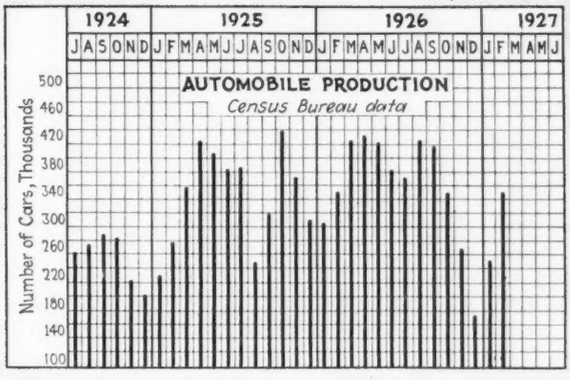
Indicators of Industrial Activity

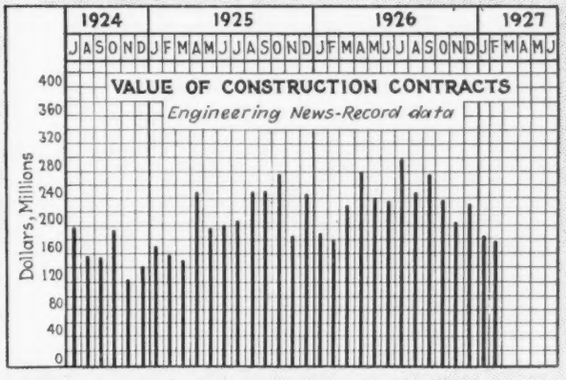
of Significance to Mining

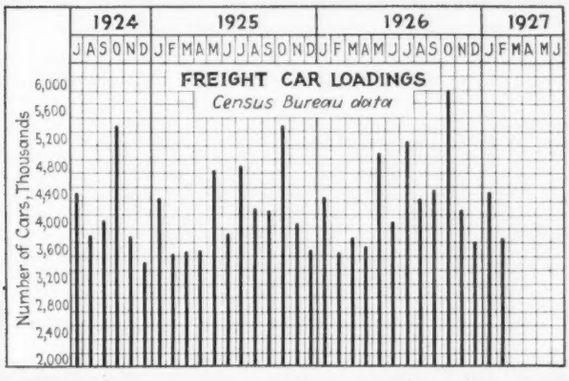

1926
1927
O N D J F M A M J J A S
E. & M. J. BAROMETER OF PRODUCTIVE OPERATIONS IN METAL MINING INDUSTRIES
Monthly Average Oct.-Dec. 1926=100
130 125 120 115 110 105 100 95 90 85 80 75 70 65
Monthly average, Oct.-Dec. 1926=100
Based Upon the Monthly Consumption of Electrical Energy Adjusted for Number of Days in Month.

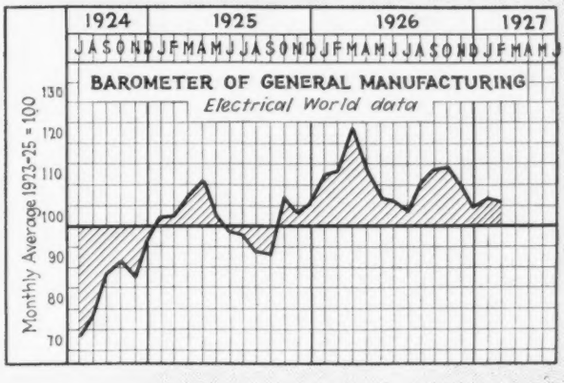

1924 1925 1926 1927
J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J
PIG IRON PRODUCTION
Census Bureau data
Gross Tons, Thousands
5,000 4,600 4,200 3,800 3,400 3,000 2,600 2,200 1,800 1,400 1,000


1924 1925 1926 1927
J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J
PETROLEUM PRODUCTION
Census Bureau data
Barrels, Millions
70 68 66 64 62 60 58 56 54 52 50


1924 1925 1926 1927
J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J
AUTOMOBILE PRODUCTION
Census Bureau data
Number of Cars, Thousands
500 460 420 380 340 300 260 220 180 140 100


1924 1925 1926 1927
J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J
VALUE OF CONSTRUCTION CONTRACTS
Engineering News-Record data
Dollars, Millions
400 360 320 280 240 200 160 120 80 40 0


1924 1925 1926 1927
J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J
FREIGHT CAR LOADINGS
Census Bureau data
Number of Cars, Thousands
6,000 5,600 5,200 4,800 4,400 4,000 3,600 3,200 2,800 2,400 2,000


1924 1925 1926 1927
J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J
BAROMETER OF GENERAL MANUFACTURING
Electrical World data
Monthly Average 1923-25 = 100
130 120 110 100 90 80 70

The Market Report

Metal Buyers Show Little Interest

Prices on Non-ferrous Metals Fairly Steady, Nevertheless

New York, March 16, 1927.— Most of the non-ferrous metals have had a quiet market in the week ending today, zinc giving the best account of itself, followed by lead, the prices of both being substantially unchanged from a week ago. Demand for copper has been almost non-existent, but most producers continue firm at 13⅜c. delivered. Tin and silver have been dull and slightly lower, silver dropping below 55c. Metal producers are not pessimistic, feeling that consumption is excellent and that the tendency to cut production of copper, zinc, and lead will prevent any material declines from present levels.

Copper Nominally 13⅜c.

Sales of copper have been disappointingly small this week, though a lull was expected after the February activity. Business was better even in the holiday weeks at the end of the year. The large producing interests seem to be uniformly quoting 13⅜c., delivered in the East, but are doing nothing, so the sale of odd lots of a hundred tons or so assumes an unusual importance. Such business has been done at 13.30@13.325c., although the sellers are not actively out after business at those levels. Foreign demand has also been exceedingly quiet. The export price remains at 13.65c., c.i.f.

Lead Quiet and Steady

Although the domestic lead market has not been brisk during the week ending today, a moderate business has been done, for the most part at uniform price levels. The American Smelting & Refining Co. has maintained its contract price for New York lead at 7.65c. and the leading interest in the West has been selling at 7.40c., St. Louis, each day. Such sales as were made at other than these prices brought moderate premiums. Some significance may be attached to the fact that virtually all of the sales were for immediate or March delivery. However, this does not mean that many buyers have not anticipated their requirements for April and even May to a considerable extent, as many of the sales in the very active period of several weeks ago were for forward delivery. Statistics for February do not reflect a decrease in the rate of production, but this should not be expected; the curtailment at the mines in February should show in the March statistics. London declined somewhat during the week until today, when an advance brought the closing price close to that of Wednesday of last week. The situation today may be described as well balanced, with little reason for apprehending any decided change in the immediate future.

Zinc More Active

Sales of zinc have been better than last week, an excellent business being done yesterday, practically all at 6.70c. Today, in spite of an advance in London, some sellers found they had to cut prices a little to attract consumers, and zinc sold at 6.675c., St. Louis. Galvanizing business is reported somewhat improved, and galvanizers have been buying largely for March and April shipment. High-grade is unchanged at 8½c., delivered in the East.

February statistics of the American Zinc Institute follow, in tons of 2,000 lb.:

Stock, Feb. 1	29,912
Produced	51,341
Shipped	48,315
Stock, Feb. 28	32,938
Shipped from plant for export	4,760
Stored for customers	531
Number retorts operating Feb. 28	85,836

Tin Down; Then Up

The tin market, as frequently is the case, has been erratic, with the foreign and domestic markets both weakening and then strengthening. Some buying by consumers is reported, but dealers and speculators dominate the market. Shipments from the Straits in the first half of March are estimated at 4,100 long tons, which indicates comparatively large supplies afloat.

Italian Lire Advance

The only material change in foreign exchanges during the week has been an

Daily Prices of Metals

Mar.	Copper	Tin		Lead		Zinc
	Electrolytic, N. Y.	99 Per Cent	Straits	N. Y.	St. L.	St. L.
10	13.15	68.875	70.25	7.65	7.40@7.425	6.725
11	13.10	68.125	69.50	7.65	7.40	6.75@6.775
12	13.10	67.75	69.00	7.65	7.40	6.75
14	13.075	67.75	68.875	7.675	7.40@7.425	6.725
15	13.075	68.125	69.375	7.65	7.40	6.70
16	13.075	68.125	69.25	7.65	7.40	6.675@6.725
Av.	13.096	68.125	69.375	7.654	7.404	6.727

Average prices for calendar week ending March 12, 1927, are: Copper, 13.131c.; 99 per cent tin, 68.188c.; Straits, 69.813c.; N. Y. lead, 7.650c.; St. L. lead, 7.431c.; zinc, 6.750c.; and silver, 55.271c.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices usually are quoted on a delivered basis; i.e., delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard.

Quotations for copper are for ordinary forms of wire bars, ingot bars, and cakes. For ingots an extra 0.05c. per pound is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight rate between the two points.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

March	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
10	56	56⅝	62½	316¾	301¼	28 3/16	28 9/16	30 15/16	31 1/16
11	56¼	56¾	62¾	314½	300¼	28⅛	28 9/16	31¼	31⅜
14	55¾	56⅜	62¾	312¼	299⅛	28 1/16	28½	31 1/16	31 3/16
15	55⅝	56⅛	62⅝	312¾	299¾	28	28 7/16	30 15/16	31⅛
16	56	56½	62⅞	314½	301¼	28⅛	28⅝	31⅛	31¼

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Mar.	Sterling Exchange "Checks"	Silver		Gold London	Mar.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
10	4.84¾	55	25 7/16	84s11½d	14	4 84¾	54¼	25 3/16	84s10¾d
11	4 84 11/16	55	25 11/16	84s10¾d	15	4 84⅞	54¼	25⅛	84s10¾d
12	4.84¾	54¾	25 7/16		16	4 84⅞	54¼	25 3/16	84s11½d
					Avg.		54 583		

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-half cent premium.

advance in lire. Closing cable quotations on Tuesday, March 15, were, francs, 3.91½c.; lire 4.52½c.; and marks 23.735c. Canadian dollars ⅜ per cent discount.

Silver Quiet

During the past week the market has been in an unsettled position, with New York quotations slightly lower than London parities. Moderate orders from India have been the chief support of the market, while it is reported that China has been a seller on most days. The market closes quiet and unshaken.

Mexican Dollars (Old Mexican pesos): March 10th and 11th, 41⅜c.; 12th, 41½c.; 14th, 15th and 16th, 41c.

Other Metals

Quotations cover large wholesale lots unless otherwise specified. London prices are according to latest mail advices.

Aluminum—Per lb., 98 or 99 per cent grade, price of leading interest, 26c.; outside market, 25.30@25.80c. London, 98 per cent, £105@£107 per long ton for domestic consumption.

Antimony—Per lb., duty paid, New York: Chinese brands, spot, nominal, 12½@12¼c.; April prices about ⅛@¼c. less; Cookson's "C" grade, spot, 16¼c. Market dull. Needle antimony nominally 8c. for lump and 10c. for powdered. White oxide, 16½c.

Bismuth—Per lb., New York, in ton lots, $2.70@$2.75. London, 10s.

Cadmium—Per lb., New York, 60c. London, Australian metal selling freely at 1s. 10d.

Iridium—Per oz., $115@$120 for 98 @99 per cent sponge and powder.

Nickel — Per lb., ingot, 35c.; shot, 36c.; electrolytic, 39c. (99.75 per cent grade). London, £170@£175 per long ton, according to quantity.

Palladium—Per oz., $59@$63. Small lots bring up to $68. Dull, but price a shade higher. Pure metal as a constituent of crude platinum, $55@$59 per oz. London, £11@£12, nominal.

Platinum — Official price quoted by the leading interest on miscellaneous orders for refined metal, $108. Open market cash sales of large lots, in New York, $101@$103. Pure metal as a constituent of crude platinum, $100@ $101. Market remains dull.

London, £22 per oz. for refined and £18½@£19½ for crude. Dull.

Quicksilver—Per 75-lb. flask, $104@ $108. Excellent demand in Europe and China. San Francisco wires $104. London, £17½.

The prices of Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Monel Metal, Osmium, Radium, Rhodium, Ruthenium, Selenium, Tellurium, Thallium, Tungsten, and Zirconium are unchanged from the issue of March 5.

Metallic Ores

Manganese Ore—Per long ton unit of Mn, c.i.f. North Atlantic ports, minimum 47 per cent Mn, 36@38c. Caucasian (washed), 53@55 per cent, 38@ 40c. Business dull. Chemical grades unchanged from quotations in the March 5 issue.

Tungsten Ore — Per unit of WO₃, N. Y.: Wolframite, $10.50@$10.75; Western scheelite, $11@$11.25. Dull; prices largely nominal.

Chrome, Iron, Molybdenum, Tantalum, Titanium, Uranium, and Vanadium Ores are unchanged from quotations in the March 5 issue.

Unchanged Prices for Zinc Blende and Lead Ore

Joplin, Mo., March 12, 1927

Blende

High	$49.80
Premium blende, basis 60 per cent zinc	$46.00@47.00
Prime Western, basis 60 per cent zinc	45.00
Fines and slimes, basis 60 per cent zinc	44.00@42.00
Average settling price, all zinc	43.58

Galena

High	$101.00
Basis 80 per cent lead	100.00
Average settling price, all lead	99.26

Shipments for the week: Blende, 16,179; lead, 2,075 tons. Value, all ores the week, $910,460.

Shipments this week covered practically all purchased ore in the bins at the end of last week, and the sales for this week totaled 15,250 tons for loading next week. It is reported that some sellers declined to accept offerings this week, but the purchases aggregate a tonnage in excess of the estimated output of 14,600 tons. To the purchase figures given above may be added 12 per cent overload, swelling the loading tonnage 2,000 tons more than the reported tonnage bought, or 17,000 tons sold. As this represents 2,400 tons more than the estimated tonnage, reports of sellers declining to accept offerings seem incredible.

There is, however, evidence that sellers are holding lead from the market in anticipation of further advances in April.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fluorspar, Fullers Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Iron Oxide, Lepidolite, Limestone, Magnesite, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystal, Silica, Spodumene, Sulphur, Talc, Tripoli, and Zircon are unchanged from prices in the March 5 issue.

Mineral Products

Arsenious Oxide (White Arsenic)—3¾c. per lb. Quiet. Cheap lots reported all sold.

Calcium Molybdate, Copper Sulphate, Sodium Nitrate, Sodium Sulphate (Salt Cake), and Zinc Oxide are unchanged from prices in the March 5 issue.

Ferro-Alloys

Ferromanganese—Domestic and foreign, 78@82 per cent, $100 per long ton, furnace or duty paid, for delivery during first half of 1927. Spiegeleisen, 19@21 per cent, $36@$37, f.o.b. furnace; 16@19 per cent, $34@$35.

Ferrotungsten—$1@$1.05 per lb. of W contained, f.o.b. works. Market spotty.

Ferrocerium, Ferrochrome, Ferrophosphorus, Ferrosilicon, Ferrotitanium, Ferro-uranium and Ferrovanadium are unchanged from prices in the March 5 issue.

Metal Products

Rolled Copper—Sheets, 22c.; wire, 15¼c. f.o.b. mill.

Lead Sheets—Full rolled, 11c. per lb.; clipped, 11¼c.

Nickel Silver—29c. per lb. for 18 per cent nickel Grade A sheets.

Yellow (Muntz) Metal—Dimension sheets, 19⅜c. per lb.; rods, 16⅜c.

Zinc Sheets—11c. per lb., f.o.b. mill.

Refractories

Chrome Brick, Fireclay Brick, Magnesite Brick, Silica Brick and Zirkite are unchanged from quotations in the March 5 issue.

Steel Steady—Pig Iron Strong—Coke Dull

Pittsburgh, March 15, 1927

Production of steel ingots was 3,725,577 long tons in February, against 3,806,888 tons in January, the daily rate increasing 6 per cent, while the January rate had been nearly 10 per cent above that of December. Based on the conventional rating February production was at 86.45 per cent of capacity, while production is now at fully 90 per cent, closely approaching the 92.58 per cent rate of last March. November and December production had been 10 per cent under that of a year previous. Thus the seasonal increase has been greater than that of a year ago.

The Steel corporation's unfilled obligations decreased 160,792 tons in January and 203,058 tons in February. There was an increase in shipments, the average daily rate of bookings being substantially unchanged. The loss is due largely to rails and tin plate, in which the bookings had previously occurred.

In each of the last three years steel production reached its peak in March and decreased continuously into July. Thus far there are only some faint indications appearing that a slight decrease may soon begin.

Finished-steel prices have now been quite steady for three or four weeks, following a period of several months of softening in spots, but there is no definite advance whatever in any line.

Automobile trade buying of steel has been increasing sharply in the last few weeks, partly making up for the light movement previously.

Pig Iron.—The Valley market is stronger. Bessemer is up 50c. on actual sales, to $19.50. Two round lots of basic have sold in the last ten days at the old price of $18, but furnaces claim $18.50 is now their quotation. An advance in foundry iron from $18.50 is predicted, but this can hardly occur with the present light buying demand.

Connellsville Coke.—Furnace coke is dull, remaining quotable at $3.35@ $3.50 for spot. Spot foundry coke is up 25c. at $4.50@$5. The Frick company is blowing in 970 ovens in the old basin.

Mining Stocks—Week Ended March 12, 1927

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda	New York	47⅛	46⅛	47	Ja. 15, Fe. 21	Q 0.75
Arcadian Consol.	Boston	*60	*60	*60		
Ariz. Com'l	Boston	8	7⅛	7⅜	Ja. 7, Ja. 28	0.50
Calaveras	N. Y. Curb			1½		
Calumet & Arizona	New York	67½	66½	67	Ma. 5, Ma. 21	Q 1.50
Calumet & Hecla	Boston	15½	14⅜	14⅜	Fe.28, Ma.15	Q 0.50
Cerro de Pasco	New York	63½	61⅛	63	Ja.13,Fe.1,	Q 1.00
Chile Copper	New York	36⅜	35⅛	36	Ma.4,Apr.1,	Q 0.62½
Con. Coppermines	N. Y. Curb	3	2½	3		
Copper Range	Boston	13⅞	12⅛	13⅛	May, 1926	1.00
Crystal Copper	Boston Curb	*28	*26	*27		
East Butte	Boston	3	3	3	Dec., 1919	0.50
Granby Consol.	New York	36	34⅜	35	May, 1919	1.25
Greene-Cananea	New York	40	35⅜	39	Nov., 1920	0.50
Hancock	Boston			*40		
Howe Sound	New York	39½	39	39	De.31, Ja.15	Q 1.00
Inspiration Consl.	New York	21¼	20½	20½	Ma.17, Ap.4,	Q 0.25
Iron Cap	Boston Curb	1½	1	1		
Isle Royale	Boston	10¼	9⅜	9⅜	Fe.4, Fe.19	Q 0.50
Kennecott	New York	63	62⅛	62⅜	Mar. 4 Apr. 1	Q 1.25
Magma Copper	New York	36⅜	34⅛	35	Dec. 1, Ja.15,	Q 0.75
Mason Valley	N. Y. Curb			1⅜		
Miami Copper	New York	16⅜	16⅛	16⅛	Fe.1, Fe. 15	Q 0.37½
Mohawk	Boston	40⅞	39	39	Ja.29, Ma.1	Q 1.00
Mother Lode Coa.	New York	4½	4	4½	De.10, De.31	SA 0.37½
Nevada Consol.	New York	14⅞	14⅛	14⅛	Ma.17,Ma.31	Q 0.37½
New Cornelia	Boston	22½	22	22	Fe.4, Fe.21	Q 0.50
Noranda	N. Y. Curb	22⅞	20⅝	22⅛		
North Butte	Boston	2⅛	2	2	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	*48	*48	*48	Se. 1, Se. 15	0.03
Old Dominion	Boston			13½	Dec., 1918	1.00
Phelps Dodge	N. Y. Curb	†132	†128		De.24, Ja.3	Q 1.50
Quincy	Boston	15	14⅛	14⅛	Mar., 1926	1.00
Ray Consolidated	New York	15⅛	14⅞	15⅛	Ap.20, Ap.30	0.25
St. Mary's Min. Ld.	Boston	24⅛	23⅛	23⅛	Fe.10 Ma.10	2.00
Seneca Copper	New York	3	2⅞	2⅞		
Shattuck-Denn	Boston Curb	5⅛	5⅛	5⅛		
Tenn. C. & C.	New York	11⅞	11⅛	11⅛	Fe.28, Ma.15,	Q 0.25
United Verde Ex.	N. Y. Curb	26⅛	25⅛	25⅛	Ja. 6, Fe. 1	0.75
Utah Copper	New York			112⅛	Ma.17,Ma.31	Q 1.50
Utah Metal & T.	Boston	1⅛	1⅛	1⅛	Dec., 1917	0.30
Walker Mining	Salt Lake	*75	*75	*75		
NICKEL-COPPER						
Internat. Nickel	New York	42	40⅛	41⅛	Ma.17,Ma.31	Q 0.50
Internat. Nickel, pfd.	New York			103⅛	Ja. 13, Fe.1,	Q 1.50
LEAD						
Gladstone Mtn.	Spokane	*28⅞	*28⅛	*28⅛	Fe. 1927	0.005
National Lead	New York	182	174½	179⅛	Ma.11,Ma.31	Q 2.00
National Lead pfd.	New York	118⅛	117⅛	118⅛	No.19,De.15	Q 1.75
St. Joseph Lead	New York	42⅞	41⅜	41½	Jn.10,Jn.20,	QX 0.75
ZINC						
Am. Z. L. & S.	New York	9½	9	9½	May, 1917	1.00
Am. Z. L. & S, pfd.	New York	49½	46½	48⅛	Nov., 1920	1.50
Butte C. & Z.	New York	4	3⅞	3⅞	De.9, De.24	0.50
Butte & Superior	New York	11⅛	10⅞	10⅞	Ma.15, Ma.31	Q 0.50
Callahan Zn-Ld	New York	2	2	2	Dec., 1920	0.50
Consol. Lead&Zinc'A'	St. Louis	16⅛	15⅛	16		
Eagle-Picher	Cincinnati	27⅞	27	27	Fe.15, Ma.1	Q 0.40
Eagle-Picher, pfd.	Cincinnati			100	De.31, Ja.15	Q 1.50
New Jersey Zn.	N. Y. Curb	189¾	181¼	189¾	Ja.20, Fe.10	Q 2.00
United Zinc	N. Y. Curb			55		
Yellow Pine	Los Angeles	*25	*25	*25	Dec. 1925	Q 0.04
GOLD						
Alaska Juneau	New York	1⅞	1⅞	1⅞		
Argonaut	Toronto	*41⅛	*37	*40		
Barry-Hollinger	Toronto	*44½	*37⅜	*40		
Carson Hill	Boston			*11		
Consol. W. Dome L.	Toronto	*13½	*10½	*11		
Cresson Consol. G.	N. Y. Curb	2⅜	2¼	2¼	De.31, Ja.10	Q 0.10
Dome Mines	New York	9	8½	9	De.31 ,Ja.30,	Q 0.50
Golden Center	N. Y. Curb			*6		
Golden Cycle	N. Y. Curb	2	1½	1⅞	Fe.28,Ma.10	Q 0.04
Hollinger Consol.	Toronto	21.35	20.70	20.90	Ma.9, Ma.25	0.10
Homestake Mining	New York	61½	61½	61½	Ma.19,Ma.25	M 0.50
Kirkland Lake	Toronto	*88	*86½	*87		
Lake Shore	Toronto	18.65	18.20	18.20	Ma.1, Ma.15	0.10
McIntyre-Porcupine	New York	26½	26½	26½	Fe.1, Ma.1	Q 0.25
Portland	Colo Springs	†*55	†*52½		Ap.6,.Ap.15,	0.02
Rand Mines	New York			9½	Au.23-30	Am .Sh. 1.52
Teck-Hughes	Toronto	6.65	6.25	6.33	Ja.31, Fe. 1	0.05
Tom Reed	Los Angeles	*50	*41½	*41½	Dec., 1926	0.02
Tough-Oakes	Toronto	*54½	*52	*53½		
United Eastern	N. Y. Curb			*45	July, 1924	0.05
Vipond Cons.	Toronto	1.46	1.40	1.43	Apr.1 Apr.15	0.03
Wright-Hargreaves	Toronto	10.75	10.35	10.50	Ja15,Fe.1	QX 0.15
GOLD AND SILVER						
Carnegie Metals	Pittsburgh	12⅞	12⅝	12⅝		
Con. Cortes	N. Y. Curb	*21	*15	*21		
Con. Virginia	San Francisco	*3	*2½	*2½		
Dolores Esperanza	N. Y. Curb			40	July, 1923	0.05
Premier Gold	N. Y. Curb	2⅛	2¼	2¼	Ma.15, Ap.4	Q 0.08
Tonopah Belmont	N. Y. Curb	1 3/16	1⅛	1⅛	Ma.15, Ap.4	0.08
Tonopah Extension	N. Y. Curb	28	28	28	Apr. 1925	0.05
Tonopah Mining	N. Y. Curb	3¼	3⅛	3¼	Ma.31, Apr.21	0.07½
West End Consol.	N. Y. Curb	*15	*12	*12	Mar., 1923	0.05
Yukon Gold	N. Y. Curb			*45	June, 1918	0.02
SILVER						
Beaver Consol.	Toronto	*67	*63	*64	May. 1920	0.03
Canadian Lorrain	Toronto	*47	*39	*40		
Castle-Trethewey	Toronto	1.06	1.01	1.01		
Coniagas	Toronto	3.99	3.99	3.99	May. 1924	0.12½
Keeley	Toronto	1.43	1.40	1.41	Fe 28, Ma.	X 0.12½
Lorrain Trout Lake	Toronto			*30	July, 1925	0.05
McKinley-Dar.-Sav.	Toronto	*14	*13½	*13½	Oct., 1920	0.03

Stock	Exch.	High	Low	Last		Last Div.
SILVER—(Continued)						
Mining Corp. Can.	Toronto	3.20	3.05	3.15	De.30, Ja.15	0.12½
Nipissing	N. Y. Curb	*5	*5	*5	De.31, Ja.20	Q 0.15
SILVER-LEAD						
Ahumada	New York	5⅛	4⅞	4⅞	De.18,Ja.5,	QX 0.15
Bingham Mines	Boston	42½	41	41	De.30, Ja.5	Q 1.00
Bunker Hill&Sullivan	N. Y. Curb	70	70	70	March 1927,	M 0.75
Cardiff M. & M.	Salt Lake	*36	*35	*36	Feb. 5, 1927	0.10
Chief Consol.	Salt Lake	2.75	2.70	2.72½	Oc.10, No.1	Q 0.10
Consti'n Mng.&Mill'g	Spokane	*32	*28½	*32		
Erupcion	Boston Curb	*87⅞	*80	*87	De.18, Ja.3	Q 0.10
Eureka Lily	Salt Lake	1.40	1.17½	1.25		
Federal M. & S.	New York	120	85	119⅜		
Federal M. & S., pfd.	New York	97	80½	95½	Fe.24, Ma.15	Q 1.75
Hawthorne Mines	N. Y. Curb	*5	*4	*5		
Hecla Mining	N. Y. Curb	15	14¼	15	Fe.15,Ma.15	Q 0.25
Highland-Surprise	Spokane	*12¾	*11½	*12¾		
Iron King Mining	Salt Lake	*56	*30	*46½		
Keystone Mining	Salt Lake	*38	*32	*38	Au.12, Au.26	0.07½
Lucky Jim	Spokane	*21	*19½	*19½		
Lucky Tiger-Com.	Kansas City	†7.25	†7.00		Ma.20, 1927	M 0.05
Mammoth Mining	Salt Lake	2.55	2.50	2.50	De.17, De.23,	Q 0.25
Marsh Mines	Spokane	3.00	3.00	3.00		
North Lily	Salt Lake	3.50	3.30	3.30		
Park Utah	New York	8	7⅜	7⅜	Ma.15, Ap.1	Q 0.20
Plutus Mining	Salt Lake	1.95	1.95	1.95	Ja.10, Ja.15	Q 0.10
San Rafael	San Francisco			*30		
Silver King Coal	Salt Lake	8.10	7.95	8.00	Ma.21, Ap.1	0.25
Silversmith	Spokane	*33	*31½	*33	Oc.1, Oc.10	Q 0.02
Strattons Mines	Spokane	*46	*41	*41		
Sunshine M. Co.	Spokane	*48	*47	*48		
Tamarack-Custer	Spokane	*33	*32	*32	Sept., 1924	0.25
Tintic Standard	Salt Lake	[11.75	11.37½	11.37½	Ma.16, Ma.29	X 0.40
Utah-Apex	Boston	6⅞	6½	6½	Oc.3, Oc.15	Q 0.25
IRON						
Bethlehem Steel	New York	50⅜	48½	49⅜	July, 1920	1.25
Butler Bro	Chicago	22⅞	22	22⅝	Ja. 29, Fe. 25	Q 0.625
Cleveland-Cliffs Iron	Cleveland	80	74	75	Ja.15, Ja.25	Q 1.00
Colorado Fuel & Iron	New York	60⅜	57⅝	58½	May, 1921	0.75
Gt. North'n Iron Ore	New York	22¼	21⅛	22⅛	Dec.6, Dec.28	0.75
Inland Steel	New York	43	42	42⅜	Fe.15, Ma.1	Q 0.62½
Replogle Steel	New York	12⅛	11⅜	12		
Republic I. & S.	New York	75⅛	69⅞	74⅜	Fe.15,Ma.1	Q 1.0
Republic I. & S. pfd.	New York	104⅜	103	104⅛	Ma.15, Ap.1	Q 1.75
Sloss-Sheffield S. & I.	New York	129	129	129	Ma.10, Ma.21	Q 1.50
Sloss-Shef. S.&I. pfd.	New York			108	Ma.21, Ap.1	Q 1.75
U. S. Steel	New York	161⅛	156⅛	160⅛	Fe.28,Ma.30	Q 1.75
U. S. Steel pfd	New York	130	129	129⅛	Ja.29, Fe.26,	Q 1.75
Virginia I. C. & C.	New York			44	Jan., 1924	1.500
Virginia I.C.&C.pfd.	New York			60⅛	De.15, Ja.2,	2.50
DIAMONDS, PLATINUM, ALUMINUM, VANADIUM, TIN						
De Beers Consol.	New York			32⅛	Ja.26, Ja.29	1.45
So. Am. Gold & P.	N. Y. Curb	3⅜	3⅜	3⅜		
Alum.Co.of Amer.	N.Y.Curb	72½	71	72		
Alum. Co. of Amerpf.	N.Y.Curb	103	102⅜	102⅞	Ma.15,Ap.1	Q 1.50
Vanadium Corp.	New York	43⅜	42⅛	42⅛	Fe.1, Fe.15,	Q 0.75
Patino M. & E.	N. Y. Curb			25	Ma.10, Ma.15	4 sh.
ASBESTOS						
Asbestos Corp.	Montreal	22⅛	21⅛	21⅛	Jan., 1926	1.50
Asbestos Corp., pfd.	Montreal	85	84⅛	84⅛	De.31, Ja.15,	Q 1.75
SULPHUR						
Freeport Texas	New York	46⅜	42⅛	45⅛	Ja.15, Fe.1	Q 0.50
Texas Gulf, new	New York	57⅛	53⅛	57⅛	Ma.1, Ma.15,	Q 1.00
MINING, SMELTING, REFINING AND GENERAL						
Amer. Metal	New York	41⅜	41⅛	41⅛	Fe.18, Ma.1	Q 0.75
Amer. Metal pfd.	New York			109	Fe.19, Ma.1	Q 1.75
Amer. Sm. & Ref.	New York	150⅛	147	149½	Ja.14, Fe.1,	Q 2.00
Amer. Sm.&Ref.pfd.	New York	120⅜	120⅛	120⅛	Fe.4, Ma.1,	Q 1.75
Consol. M. & S.	Montreal	255	245	253⅜	De.31, Ja.15	X 6.25
Federated Metals	N. Y. Curb	13⅜	13⅜	13⅜		
Newmont Mining	N. Y. Curb	72	71	72	De.31, Ja.17,	0.60
U. S. Sm. R. & M.	New York	36⅛	35⅞	36⅛	Ja.6, Ja.15,	Q 0.87½
U. S. Sm. R.&M.pfd.	New York	48⅜	47⅞	48⅛	Ja.6, Ja.15,	Q 0.87½

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. F, four weeks. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, J. A. Hogle & Co.; Colorado Springs, Colo., Henry Sachs.

LONDON QUOTATIONS—WEEK ENDED MARCH 1, 1927

Name	High	Low	Last	Date	Last Div. Amount
Aramayo Mines (25 frs.)	79/6	77/6	77/6	Feb. 1927	5 (†)
British Platinum (£1)	3/3	2.10½	3/—	Feb. 1925	2½ p.c.
Burma Corpn. (10 rupees)	14/3	13/1½	13/6	Feb. 1927	6 annas*
Bwana M'Kubwa (5s)	6/4½	5/9	6/4½		
Camp Bird (2s)	4/9	3/3	3/4½		
El Ore (£1)	4/9	4/3	4/7½	Nov. 1924	2½ p.c.*
Esperanza (10s)	—/2	—/1	—/2		
Frontino & Bolivia (£1)	12/—	11/10½	12/—	Jan. 1927	5 p.c.
Mexican Corpn. (£1)	10/1½	9/—	10/—		
Mexico Mines of El Oro (£1)	18/9	15/7½	18/9	Dec. 1926	3½ p.c.*
N'Changa Copper Mining	16/9	15/—	15/—		
Oroville Dredging (£1)	5/3	4/6	4/9	Dec. 1923	3¾ p.c.
Ouro Preto (£1)	2/1½	2/—	2/—	May 1925	2½ p.c.
Rhodesian Congo Border (£1)	73/9	60/—	70/—		
St. John del Rey (£1)	12/7½	12/—	12/6	June 1925	6½ p.c.
San Francisco Mines (10s)	31/6	30/3	30/9	Jan. 1927	25s.
Santa Gertrudis (£1)	16/9	16/—	16/3	Jan. 1927	3½ p.c.
Selukwe (2s. 6d.)	10/6	8/9	10/3	April 1917	6¼ p.c.
S. Amer. Copper (2s.)	3/4½	3/—	3/3	Nov. 1917	75 p.c.
Tanganyika (£1)	55/9	46/9	44/4½	Aug. 1926	7½ p.c.
Tomboy (£1)	3/6	3/—	3/3	July 1 26	10 p.c.
Union Miniere du Haut-Katanga (Brussels)	8.950	8.800	8.850	July 1926	175 (‡)

* Free of British income tax. † Swiss frs. ‡ Belgian frs. and free of taxation.